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# THE GENUS *HYPOXIS* (HYPOXIDACEAE) IN CENTRAL AFRICA<sup>1</sup>

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## ABSTRACT

*Hypoxis* is a pantropical genus, with about 100 species worldwide. It is represented in Central Africa by 20 species, with 3 species in Rwanda, 5 in Burundi, and 19 in Congo-Kinshasa. This study considers morphology of vegetative and reproductive organs with emphasis on leaves, inflorescences, seeds, and indumentum. Morphology and anatomy of trichomes and other new data on taxonomically useful characters of *Hypoxis* in Central Africa are assessed.

**Key words:** Africa, anatomy, Hypoxidaceae, *Hypoxis*, morphology.

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Morphological variability of *Hypoxis* L. confuses its taxonomy and nomenclature. Established by Linnaeus (1759), *Hypoxis* has often been divided into two infrageneric taxa, one including plants with indumentum and the other including glabrate species. The first has been described as *Hypoxis* subg. *Euhypoxis* Baker (1878b: 99), *Hypoxis* sect. *Euhypoxis* (Baker) Benth. (Bentham & Hooker, 1883: 717), or *Hypoxis* sect. *Hypoxis* (Geerinck, 1969: 75).

Salisbury (1866) first described the second group as two distinct genera, *Ianthe* Salisb. and *Spiloxene* Salisb., to which almost glabrous South African plants belong. Baker (1878b: 99) treated both *Ianthe* and *Spiloxene* as synonyms of *Hypoxis* subg. *Ianthe* (Salisb.) Baker. Subsequently Williams (1901) and Nel (1914a, b) recognized *Ianthe* as a separate genus (Nel misspelled it as *Janthe* Salisb.), and both of them explicitly included *Spiloxene* in its synonymy. Their taxonomy was endorsed by Hilliard and Burt (1978), but they mistakenly used *Spiloxene* as the name of the genus, a usage not permitted under ICBN Article 11.5 (Greuter et al., 2000: 21). In this paper I recognize *Hypoxis* and *Ianthe* as separate genera, and therefore the description given is of *Hypoxis* sensu stricto (excluding *Ianthe*).

No recent thorough study of *Hypoxis* exists for Central Africa, consisting herein of Democratic Republic of Congo (= Congo-Kinshasa), Rwanda, and Burundi. This paper is based mainly on morphological characters, though apomixis and pseudoga-

my have been confirmed for some African species (Wilsenach, 1967; Wilsenach & Papenfus, 1967; Wilsenach & Warren, 1967; Zimudzi, 1994). Molecular studies of all *Hypoxis* species from tropical Africa, as delimited by Lebrun and Stork (1991), are planned for the future.

## MATERIALS AND METHODS

Approximately 300 herbarium sheets from B, BM, BR, BRLU, K, KRA, KRAM, MO, O, P, POZG, UPS, WAG, and Z were used for morphological and biometric studies (Index to Exsiccatae follows the Literature Cited). Flowers from herbarium specimens were boiled in water for morphological analysis under a dissecting microscope. Trichomes were taken from boiled scapes and leaves and examined using ordinary and polarizing light microscopy, with drawings made from the light microscope. Freeze-dried seeds and also some trichomes were examined using scanning electron microscopy after coating with gold. Data on ecology and distribution were taken from the herbarium labels. Distribution data in the text are presented in the original languages.

## RESULTS AND DISCUSSION

Of the 20 species of *Hypoxis* known from Central Africa, 19 occur in the southern and eastern parts of Congo-Kinshasa, with only 1 species, *H. angustifolia* Lam., extending into the western part of the country. Only 3 species occur in Rwanda and 5 in

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Burundi. The largest number of taxa in Congo-Kinshasa (18) is found in the Shaba Province. This situation is a consequence of two factors. First, southern and eastern parts of Congo-Kinshasa are covered with wooded grassland, the habitat in which most species of the sun-loving genus *Hypoxis* grow. Many species of the genus are characteristic floristic elements of the Zambezian regional center of endemism (White, 1983). Second, Shaba is a center of endemism itself, in part due to altitudinal and edaphic diversity, with local areas of soils with high levels of heavy metals (Duvigneaud, 1958; Duvigneaud & Denaeyer-De Smet, 1963; Malaisse, 1983; Mandango & Ndjele, 1994).

Nel (1914a) divided the African species of *Hypoxis* into 11 sections on the basis of variation in four features: morphology of anther apex, relative lengths of style and stigma, leaf width, and number of nerves in leaf blades. Unfortunately, these sections are not of much practical value. Characters of the gynoecium are not stable in polymorphic species, as, for example, *H. angustifolia* and *H. hockii* De Wild. The width of the leaf lamina depends on the age of the leaf, as well as the age of the plant, and it must be specified whether inner or outer leaves are measured. For these reasons I did not assign Central African species to Nel's sections. My studies led me to the conclusion that seed and indumentum characters are the most useful for determining taxonomy and relationships within this genus.

Dimensions and shapes of seeds are similar in all Central African species. Seeds are usually ovoid or almost spherical in shape, and 1 to 2 mm in diameter. The seed coat of *Hypoxis* is encrusted with phytomelan and, therefore, black (Oganezova, 1995). Cells are isodiametric, 5–7-gonal, with straight boundaries (Figs. 3B, 10E, F, 14B & D, 16B, 19B). The anticlinal cell boundaries may be slightly raised (Figs. 10E, F, 14A, B & D, 19B) or channeled (Figs. 3B, 10F, 12B, 16B). Outer periclinal walls of cells may be slightly sunken (Fig. 14B), flat (Figs. 10F, 14D), concave (Fig. 2A), or more or less convex (Figs. 2C, D, 3, 5, 7, 10A–E, 12, 16, 17, 20). In the micropylar part of the seed the outer periclinal walls tend to be more raised than in other parts of the seed (Figs. 10D, 14A). The raised convex papillae may be semispherical (Figs. 3B, 12, 16B), conical (e.g., Figs. 2D, 7D, 10C, 17B, 20D), or nipple-shaped and aculeate (Fig. 10E). The flat or concave papillae are usually smooth in appearance, except *H. hockii* var. *colliculata* Wiland, where they are micropapillate (Fig. 10F), a feature visible even under the dissecting microscope.

The cuticle covering seed coat cells may be very thin (Oganezova, 1995) or very thick in some species (Nordal et al., 1985). In the former the seeds are black, in the latter red-brown or brown due to cuticle coloring. In *H. angustifolia* the thick cuticle is iridescent, as is common in some American *Hypoxis* species (Brackett, 1923). The Central African species fall into two main groups according to seed coat differences: 11 species with brown seeds with a thick layer of cuticle and 8 species with black seeds and a thin layer of cuticle. If the cuticle is thin, it smoothly covers the cell surface. Under high magnification ( $\times 625$ ), however, micropapillation is visible (Fig. 16B). The thick cuticle is usually highly wrinkled (Figs. 2C, 3B, 5B, D, 7B, D, 10A, 12D, 13B, 20B, D), and it creates small wings along papillae, so they look like more or less elongated pyramids. The only exception is the seed coat of *H. muhilensis* Wiland subsp. *muhilensis*, where the thick cuticle covers the papillae smoothly, but forms elongated appendages at their apexes (Fig. 17B).

Brackett (1923) and McVaugh (1989) extensively used seed coat structure in keys to the American species of *Hypoxis*. Nordal et al. (1985) and Zimudzi (1996) applied this character to identification of the East African and Zambesian species, respectively. Because it is not known how many genes are expressed in the development of different kinds of seed coat in *Hypoxis*, some researchers (Britt, 1967) believe that they do not constitute differences great enough to warrant separation into distinct species. However, as stated by Barthlott (1981), differences of surface characters always seem to be based on genetic diversity and may have taxonomic importance. In this treatment of Central African *Hypoxis*, seed coat sculpture was evaluated according to its correlation with other morphological characters useful in the delimitation of species. In *H. hockii* three different types of seed coat sculpture occur. It is not possible to state now whether this seed coat heteromorphism is correlated with anything other than genetic polymorphism in this morphologically highly variable species. Because there is no visible correlation with any other factor, the rank of variety is used. In other cases in which there are more supportive characters, seed coat sculpture is used as an additional feature in delimitation of species or subspecies.

All Central African species of *Hypoxis* have vegetative and reproductive organs covered with indumentum. Because *Hypoxis* species occur in areas with a long dry season, the structure of some of their organs, for example the rhizome or roots,



shows xeromorphic features. Some authors (e.g., Nel, 1914a) consider the indumentum of these plants to be an adaptation to minimize transpiration rates. In some species the trichomes fall off with age and as a result some organs become nearly glabrous.

Trichomes of the Central African species of *Hypoxis* have a characteristic structure. Trichome branches grow out of a base (foot) consisting of 4 to 8 cells of an oval or irregular shape. These cells are very well distinguished because they stand out from the surrounding epidermal cells and contain a large, ovoid, dark cell nucleus. Trichome branches do not enclose any cytoplasm, and only remnants of transverse cell walls can be observed. The trichome branches have so far been considered unicellular; however, when examining the cell wall it is easy to note several protuberances on its surface, which are the remains of the transverse walls of the cells that form the branch. They are particularly visible by polarized light, but hardly noticeable under an unpolarized light microscope. This is the reason for the lack of transverse walls in the illustrations. The thickness of the cell walls varies in the individual taxa. Likewise, the hollow core has a variable diameter and may reach the branch apex (Figs. 8H–J, 9E, F, I, J, 18G) or only occur in its basal part (Fig. 15C). The trichome branches are slightly distended in the basal part; in the upper part they become gradually narrower. In some taxa the trichome branches show a tendency to twist (Fig. 1E, F). The branch length ranges from 0.1 to 5.3 mm.

Within Central African *Hypoxis* species there are three types of trichomes distinguished on the basis of the number of branches:

a. Simple trichomes observed on the margin of bracts in *H. urceolata* Nel (Fig. 18C) and *H. angustifolia*; they may rarely occur together with two-branched trichomes on the leaf surface;

b. Two-branched trichomes with base bearing two many-celled branches (Fig. 18I); usually one branch is longer than the other; two-branched trichomes occur most frequently on leaves, but may also appear in the inflorescence;

c. Tufted trichomes with base bearing 3 to 13 many-celled branches; branches differ in length, with one branch always much longer than the others; exceptionally, two longer branches may occur; tufted trichomes may occur on all organs (Figs. 1E, F, 8I, J, 9E, F, I, J, 11D, E, 13C, 15C, D, 18G).

One or two trichome types may occur on one

plant. Almost all species have most parts of scapes, pedicels, and flowers covered with tufted trichomes. Two-branched or simple trichomes on these organs are rare and usually correlated with scarce indumentum on the leaves.

Although some trichome and indumentum types are species-specific, there are patterns common to the whole genus. Indumentum is distributed on both the inner and outer leaves. In *H. lejolyana* Wiland, trichomes are present on the tunic. Outer leaves are usually covered with trichomes on the whole blade surface below and more sparsely so above. The trichome topography on the inner leaves is more variable and can be divided into the three following types:

1. Trichomes present on the entire upper and lower surface of the leaf (e.g., *H. urceolata*).

2. Trichomes on the margins, the midrib beneath, and on the surface of the lamina above or below (Fig. 4).

3. Trichomes distributed only on the margins of the blade and on the midrib below (Fig. 1A).

The trichomes on the compressed scape of *Hypoxis* are irregularly distributed. The lower part of the scape is ciliate, but toward the middle sporadic trichomes occur on the surface of the scape, and in the uppermost part the indumentum becomes dense, especially in the pedicel zone. Bracts are covered with indumentum only on the abaxial (outer) side with the trichomes usually restricted to the midrib, but sometimes they may also be present on the lamina, especially toward the base (Fig. 1B). In *H. urceolata*, *H. goetzei* Harms, and *H. angustifolia*, margins of the bract may be ciliate with single- or two-branched trichomes (Figs. 8C, 18C). Bracts in the basal part of the inflorescence are larger and with more trichomes. Pedicels and ovaries usually have indumentum as dense as the upper part of the scape. The outer tepals have a dense indumentum on the entire abaxial surface (Figs. 1A, 4, 11B), and sometimes have a protruding row of perpendicular trichomes along the midrib below. The inner tepals are almost glabrous except for the abaxial midrib (Figs. 8A, 18A), which bears trichomes extending from the segment base toward the apex and covering from  $\frac{1}{3}$  to its entire length. Additionally, on the adaxial surface of the tepals one may observe single-celled papillae that are pyramidal and larger on the inner tepals than on the outer.

The overall appearance of a plant depends on the indumentum density, its position relative to the organ surface, and color. Trichomes may be hyaline,



grayish, yellowish, golden, or red-brown. Within some species, indumentum has variable colors, for example, different on the outer and inner leaves, but normally the color for an individual taxon is consistent. The indumentum color may also vary with age. Moreover, Nel (1914a) reported transitions of the indumentum color on one individual of South African *H. sobolifera* Jacq. In the Central African species of *Hypoxis*, different types of indumentum occur: villous (*H. lusalensis* Wiland), tomentose (leaves of *H. bampsiana* Wiland), pilose (*H. angustifolia*), hispid (*H. angolensis* Baker), pubescent (*H. hockii* var. *hockii*), or ciliate (leaves of *H. goetzei*). Indumentum density ranges from very compact and dense to sparse or sporadic.

Studies on trichomes of *Hypoxis*, first done by Scharf (1892) and subsequently extended by Nel (1914a), Heidemann (1983), and Nordal et al. (1985), focused mainly on eastern and southern African taxa. Scharf (1892) and Nel (1914a) tried to explain the process of trichome formation, but despite performing their studies on the same South African species (*H. stellipilis* Ker-Gawl.), their observations differed. Whereas Scharf studied the structure of trichomes on the scape, Nel concentrated on the leaves, which have a different trichome type. More recently, Hummel and Staesche (1962), Heideman (1983), and Nordal et al. (1985) discussed a simplified trichome structure in the genus *Hypoxis*. Heideman (1983) and Nordal et al. (1985) presented the trichome foot composed of only one cell with unicellular branches. Hummel and Staesche (1962) mentioned that Hypoxidaceae have many-celled, tufted trichomes. The trichome topography on *Hypoxis* plants was considered a systematic feature with reference to the South African (Heideman, 1983) and East African (Nordal et al., 1985) species. In the latter work, the authors suggested six types of trichome distribution on the leaves, but these types do not include all the variability observed in Central African species, e.g., *H. bampsiana*. The various features of trichomes and indumentum have proven to be useful in creating the keys to the Central African taxa of *Hypoxis*.

In the studied material there were a few specimens that could not be included in any of the species treated below. Their taxonomic status is currently being examined and will be reported in a later publication. Due to the political situation in Central Africa, there are currently no possibilities of performing experimental biological tests in situ,

and access to living material is limited as well. Consequently, the current paper presents  $\alpha$ -taxonomy based on available data. More studies concerning apomixis and pseudogamy of *Hypoxis* in Central Africa and in other parts of the continent are needed, as well as evaluation of a species concept in this genus.

**Hypoxis** L. Syst. Nat. ed. 10. 1759. TYPE: *Hypoxis hirsuta* (L.) Colville (syn.: *H. erecta* L.).

*Herbs* with perennial rhizomes or corms; underground parts globose, ovoid or elongate, yellowish or whitish inside, usually topped by a tunic of membranous and/or fibrous remains of old leaves; roots thick, ribbon-like, contractile. *Leaves* in a basal rosette, often tristichous, usually diversified into outer leaves, developing at beginning of growing season, and inner leaves developing later, both with parallel nervation; *outer leaves* wider and shorter than inner leaves, in basal part usually spathe-like, with membranous margins, enclosing bases of the inner leaves in long or short pseudostem, in upper part ovate, lanceolate, ensiform, linear or canaliculate, acute at apex, often keeled, erect or reflexed, covered with indumentum; *inner leaves* ovate, lanceolate, ensiform, linear or canaliculate, acute at apex, often keeled, erect or slightly reflexed,  $\pm$  covered with trichomes. *Scapes* compressed, usually tapering toward base, winged and ciliate in lowest part, wider and more covered with trichomes in upper part; *flowers* single or in determinate or indeterminate inflorescences; *bracts* subulate or ovate in basal part, acute, keeled, those subtending lowermost flowers larger than in upper part of inflorescence; *pedicels*  $\pm$  distinct, covered with trichomes. *Tepals* usually 6, sometimes only 4, rarely 3 or 5, yellow entirely or at least on upper side; *outer tepals* ovate, lanceolate or oblong, acute, with an adaxial subapical appendage, often keeled, covered with trichomes abaxially; *inner tepals* ovate or lanceolate, acute, obtuse, entire or micropapillate at apex, with trichomes along midrib abaxially; *stamens* biseriate, as many as tepals, equal or unequal with outer whorl longer than inner; *filaments* usually subulate, exceptionally filiform or deltoid; *ovary* inferior, trilocular with axile placentation, usually obconical, covered with indumentum. *Capsule* with persisting perianth, transversely circumscissile in upper part and sometimes dehiscing by longitudinal slits as well; *seeds* ovoid or subglobose, with one large papillate appendage, black or brownish; seed coat usually  $\pm$  papillate.



KEY TO *HYPOXIS* SPECIES IN CENTRAL AFRICA

- 1a. Inner leaves 8–30 mm wide, coriaceous; rhizomes 27–60 mm diam., scapes 2–5 mm wide.
- 2a. Inner leaves glabrous above, ciliate only on margins and midrib below or entirely covered with indumentum below.
- 3a. Leaf blade entirely covered with indumentum below.
- 4a. Flowering sequence acropetal; indumentum red-brown, inner leaves 30–70 (–76) mm wide, (95–) 103–190-nerved ..... 3. *H. bampsiana*
- 4b. Flowering sequence basipetal; indumentum white; inner leaves 8–20 mm wide, ca. 30-nerved ..... 17. *H. subspicata*
- 3b. Leaf blade ciliate only on margins and midrib below.
- 5a. Flowering sequence basipetal, trichomes golden; inner leaves (8–) 20–50 (–70) mm wide ..... 7. *H. goetzei*
- 5b. Flowering sequence acropetal, trichomes white or gray; inner leaves 6–16 mm wide ..... 1. *H. angolensis*
- 2b. Inner leaves entirely covered with indumentum on both sides.
- 6a. Inflorescence 2- to 7-flowered; plant from Haut Zaire Province or Rwanda ..... 20. *H. urceolata*
- 6b. Inflorescence 6- to 13-flowered; plant from Shaba Province.
- 7a. Inflorescences accompanied by inner leaves during anthesis ..... 8. *H. hockii*
- 7b. Inflorescences not accompanied by inner leaves during anthesis ..... 16. *H. robusta*
- 1b. Inner leaves 1–8 mm wide, usually thin in texture; rhizomes 6–45 mm diam., scapes 0.3–2 mm wide.
- 8a. Tepals 14–20 mm long ..... 11. *H. lusalensis*
- 8b. Tepals 6–13 mm long.
- 9a. Leaves canaliculate, to ca. 1 mm wide.
- 10a. Tunic membranous, with only few delicate fibers; leaves ca. 0.7 mm wide ..... 6. *H. filiformis*
- 10b. Tunic fibrous and stiff, leaves ca. 1 mm wide ..... 4. *H. canaliculata*
- 9b. Leaves carinate or flat, 1 mm or more wide.
- 11a. Inner leaves ensiform, 6–8 mm wide; tunic fibrous ..... 5. *H. dinteri*
- 11b. Inner leaves linear, 1–8 mm wide; tunic fibrous or membranous.
- 12a. Tunic conspicuous, stiff and prominently fibrous or composed of 2–3 mm wide old leaf blades.
- 13a. Tunic composed of 2–3 mm wide blades often covered with indumentum ..... 10. *H. lejolyana*
- 13b. Tunic fibrous, glabrous.
- 14a. Plants 7.5–10 cm high, seeds brown ..... 18. *H. symoensiana*
- 14b. Plants 20–50 cm high, seeds black ..... 13. *H. malosana*
- 12b. Tunic not conspicuous, at least partially membranous.
- 15a. Outer tepals ca. 5 mm wide ..... 19. *H. upembensis*
- 15b. Outer tepals 2–4 mm wide.
- 16a. Seeds black.
- 17a. Scapes bending after anthesis; pedicels 2.5–6 mm long; seed testa colliculate ..... 9. *H. kilimanjarica*
- 17b. Scapes erect after anthesis; pedicels 7–12 mm long; seed testa honeycombed ..... 12. *H. malaissei*
- 16b. Seeds brown.
- 18a. Flowers 1 or 2.
- 19a. Pedicels 0–5 mm long; scapes bending after anthesis ..... 14. *H. monanthos*
- 19b. Pedicels 12 mm or more long; scapes erect after anthesis ..... 2. *H. angustifolia*
- 18b. Flowers 3–6.
- 20a. Tunic partially fibrous; robust plant known only from Plateau de Muhila ..... 15. *H. muhilensis*
- 20b. Tunic membranous; slender common plant ..... 2. *H. angustifolia*

**1. *Hypoxis angolensis*** Baker, Trans. Linn. Soc. London, Bot. 1: 266. 1878. TYPE: Angola. Huilla: "in collinis dumetosis prope Lopollo, 3800–5500 ft.," 1860, *Welwitsch 4059* (holotype, BM!). Figures 1, 2A, B.

*Herb* to 48 cm high; *rhizome* ovoid, 6.4–11.0 × 3.9–5 cm (dried out); tunic to 8 cm, usually large and fibrous, brown-red. *Outer leaves* 3 to 5, ovate, 6–14 × 0.8–1.4 cm, ciliate on the margins and

midrib below, glabrous above; trichomes tufted, white; nerves of unequal size, (29 to) 39 to 67; *inner leaves* 8 to 27, linear, (12–) 21–48 (–66) × 0.6–1.6 cm wide, in basal part wider and with membranous margins, prominently keeled, ciliate on the margins and midrib below, glabrous above; trichomes tufted, ca. 4-branched with branches 0.5–2.7 mm long, white or gray; thin nerves of equal size, approximate, (29 to) 33 to 67. *Scapes* 3 to 13, 13–27 cm



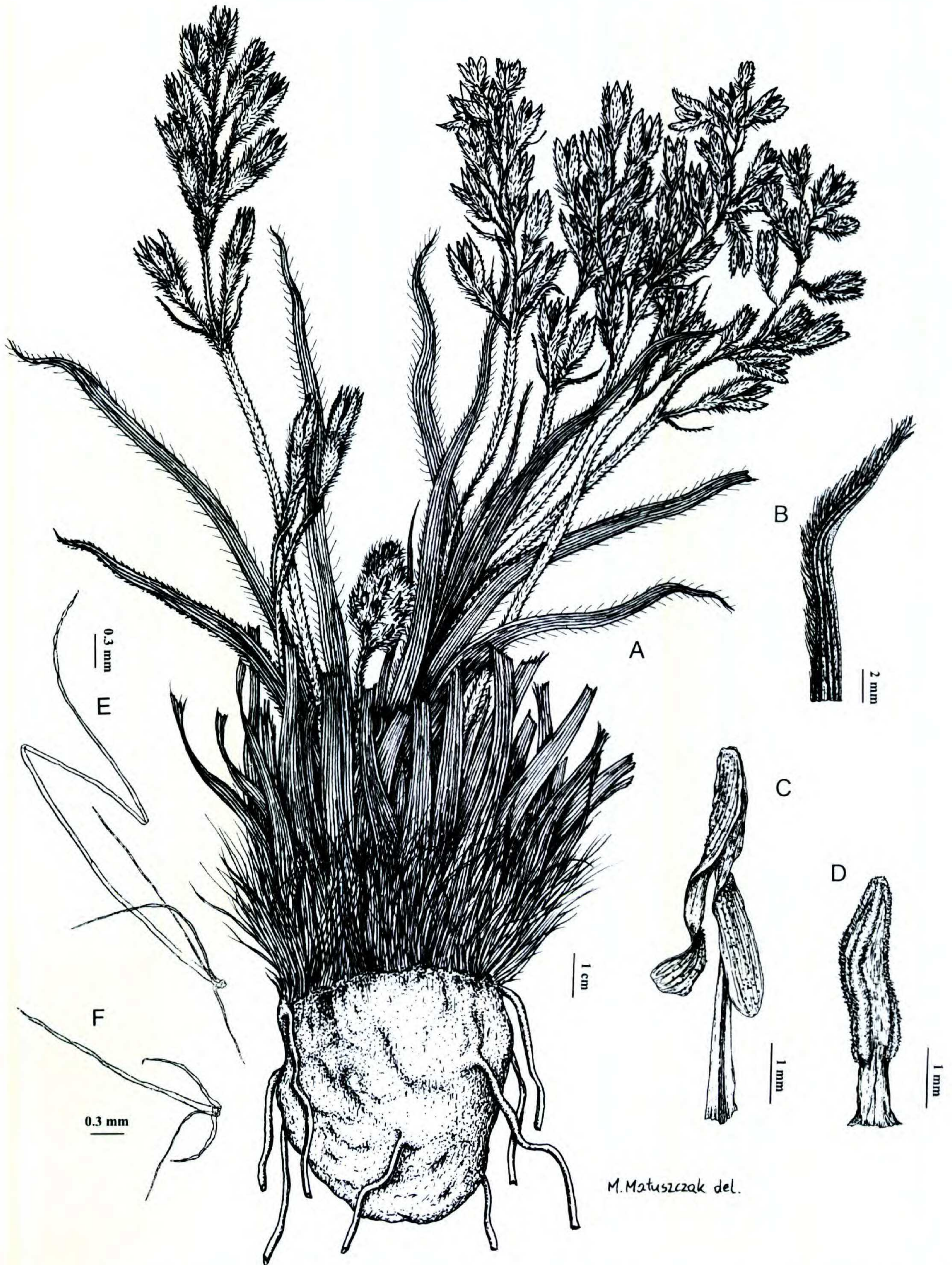


Figure 1. *Hypoxis angolensis*. —A. Habit. —B. Bract from the basal part of inflorescence in side view. —C. Stamen (ventral view). —D. Style with stigma. —E. Tufted trichome from a scape. —F. Tufted trichome from a leaf edge. A from *Dwigneaud 1321* (BRLU); B from *Plancke 167/2550* (BRLU); C, D, E, and F from *Lisowski, Malaisse & Symoens 13279* (POZG).



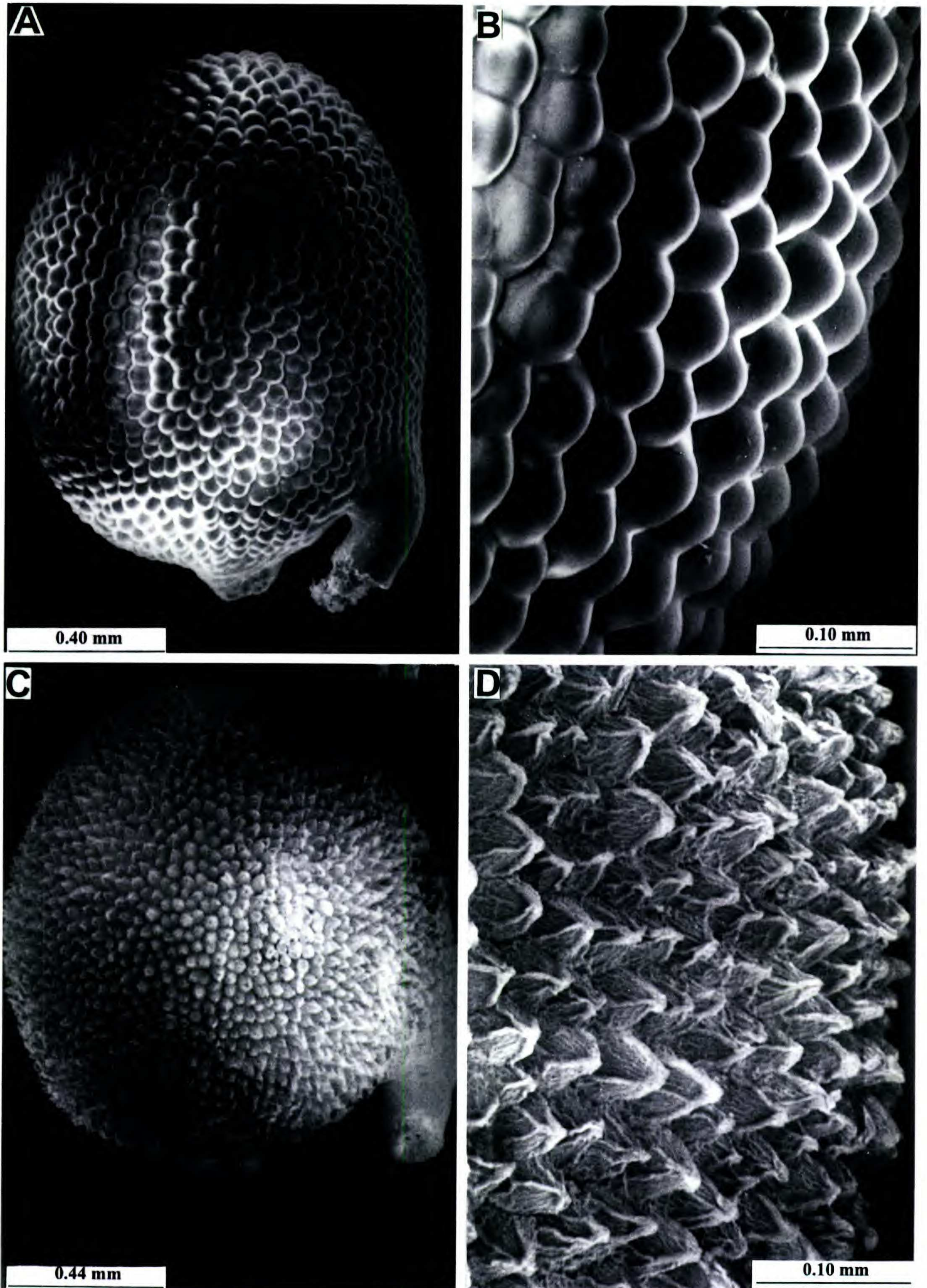


Figure 2. A, B. *Hypoxis angolensis*. —A. Seed. —B. Seed coat sculpture. C & D. *Hypoxis muhilensis* subsp. *kansimbensis*. —C. Seed. —D. Seed coat sculpture. A and B from *Duvigneaud & Timperman 2514* (BR); C and D from *Lisowski 81125* (POZG).



× 3–4 (–5) mm, basally tapering, shortly winged and ciliate, in upper half prominently hispid with tufted trichomes; *raceme* 6- to 12-flowered, floral anthesis acropetal; *bracts* subulate, lowermost 11–25 × 1.5–2.0 mm, 7-nerved, pubescent on midrib and nerves abaxially; upper bracts much smaller, almost filiform; *pedicels* 4–23 mm long, hispid. *Tepals* 6; *outer tepals* oval, 9–16 × 3–5 mm, 5- to 9-nerved with irregular nerves, abaxially hispid; appendage clavate; *inner tepals* ovate, obtuse, 9–14 × 4.5–10.0 mm, 5- to 7 (–10)-nerved with irregular nerves, pubescent abaxially along the midrib; *stamens* subequal or inner shorter than outer; outer stamens 5–9 mm long with filaments 3.5–4.5 mm long; inner stamens 4.5–7.5 mm long with filaments 2.5–3.5 mm long; *anthers* linear, prominently sagittate, slightly emarginate or fused at apex, 3.5–5.0 mm long; *ovary* 4.5–13.0 × 3.5–6.0 mm, hispid; *style* 1–2 mm long; *stigma* pyramidal, 1.5–3.0 mm long. *Capsule* obconical, 6–10 × 4–5 mm, hispid; *seeds* 6 to 9, ovoid, 1.2–1.5 × ca. 1 mm, black; seed coat colliculate.

*Distribution and ecology.* Congo-Kinshasa (Fig. 22), Angola, Zambia, Tanzania. Wooded grassland with shrubs or trees, often with *Diplorhynchus* and *Hymenocardia*; miombo. Red, degraded, moist, sandy soils; alt. 1340–1800 m. Flowering from June to December. Inner leaves are produced during flowering.

*Additional specimens examined.* CONGO-KINSHASA. **Shaba:** 60 km N de Sandoa, *Duvigneaud & Timperman 2481* (BRLU); 70 km S de Sandoa, *Duvigneaud & Timperman 2514* (BRLU); 10°48'10"S, 25°16'49"E, *Schaijes 2985* (BR); entre Kansenia et Kapiri, près du village Kamalenge, *Lukuesa 116* (BR); Plateau des Bianco, entre Dilungu Yulu et Kansenia, à l'W de la route Tenke-Kansenia, *Symoens 5886* (BR); same plateau, au N de Tenke, *Duvigneaud 1321H* (BRLU); Plateau de la Manika, *Duvigneaud s.n.* (BRLU); environ de Katema, *Lisowski, Malaisse & Symoens 13279* (POZG); près de Djoni, *Lisowski, Malaisse & Symoens 5637* (POZG); Kolwezi, *Plancke 167/2550* (BRLU), *Duvigneaud 4527 H* (BRLU), *Duvigneaud & Timperman 2264* (BRLU), *Schmitz 2977* (BR). ZAMBIA. **Nyanga:** Rochdale Valei, 14.12.1976, *A. Nicholas 502* (MO). TANZANIA. **Iringa:** Iringa–Mbeya Road, vicinity of Ngwazi Estate, *Spjut & Muchai 3462* (MO).

*Hypoxis angolensis* is a very beautiful species with hispid, light indumentum on leaves and inflorescences (Fig. 1A). Trichomes are usually composed of only four branches, which tend to twist themselves (Fig. 1E, F). The rhizome is often topped with a rich fibrous chestnut-colored tunic. The geographic distribution of *H. angolensis* is very similar to that of *H. subspicata*. Both species share leaves with approximate nerves, but leaves of *H. subspicata* are covered on the whole surface below,

whereas leaves of *H. angolensis* are only ciliate on margins and midrib below. These two species also have very different inflorescences. *Hypoxis angolensis* possesses a raceme with acropetal anthesis (Fig. 1A), while *H. subspicata* bears cymes with basipetal anthesis. Moreover, seeds of *H. angolensis* are black with a thin cuticle, whereas seeds of *H. subspicata* are brown with a thick cuticle. *Hypoxis angolensis* is also similar to *H. hockii*, but the latter has leaves totally covered with indumentum and their nerves are visibly distant one from another, not close together like in the former species. Seeds of both species are black, but their seed coat sculptures are different (see Figs. 2A, B and 10C–F).

**2. *Hypoxis angustifolia*** Lam., *Encycl.* 3: 182. 1789. TYPE: Mauritius. *Commerson s.n.* (holotype, P photo!). Figures 3, 18H, I.

*Hypoxis luzuloides* Robyns & Tournay, *Bull. Jard. Bot. État.* 25: 254. 1955. TYPE: Congo-Kinshasa. Kivu: "Tschambi, plaine près du pont de la Rwindi," alt. ± 975 m, Oct. 1933, *G. de Witte 1130* (holotype, BR!).

*Herb* to 10–53 cm high; *rhizome* globose, 0.8–1.2 cm diam. (dried out), white inside; tunic membranous, sometimes with some thin fibers. *Outer leaves* not always present, if present not numerous, grouped in pseudostem, linear in upper part, 10 cm × ca. 7 mm, pilose along midrib and margins below; trichomes 2-branched, white; nerves of unequal size, 5 to 13; *inner leaves* 3 to 12, linear, grass-like, usually keeled, 10–50 cm × 3–8 mm, ciliate on margins and midrib below or very sparsely pilose on entire surface; trichomes 2 (3)-branched, 1.3–2.5 mm long, golden or white, soft; nerves of unequal size 5 to 13 (23), two lateral nerves prominently larger than other. *Scapes* 1 to 6, 5–20 cm × 1 mm, ciliate in lower half, pilose in upper half with 2- to 3-branched trichomes; *flowers* single or in a lax 2- to 6-flowered corymbiform cyme; *bracts* subulate, 12–17 mm long, basally (0.5–) 1.0–1.7 mm wide, 1- or 3-nerved, villous on midrib abaxially, sometimes ciliate on margins; *pedicels* 1.2–2.5 cm long, pubescent. *Tepals* 6 (exceptionally 4), yellow, bright yellow, or outer tepals green and inner yellow, sometimes with a red stripe along midrib; *outer tepals* ovate, 5–8 × 2–3 mm, 5- to 7-nerved with irregular nerves, villous abaxially; appendage clavate; *inner tepals* ovate, obtuse, sometimes minutely papillate on apex, 4–7 × 3–4 mm, 5- to 7-nerved with irregular nerves, pilose along midrib abaxially to 3/4 of its length; *stamens* usually unequal; outer stamens 3–4 mm long with filaments 2.5–3.0 mm long; inner stamens 2–3 mm long with filaments 1.5–2.0 mm long; *anthers* linear,



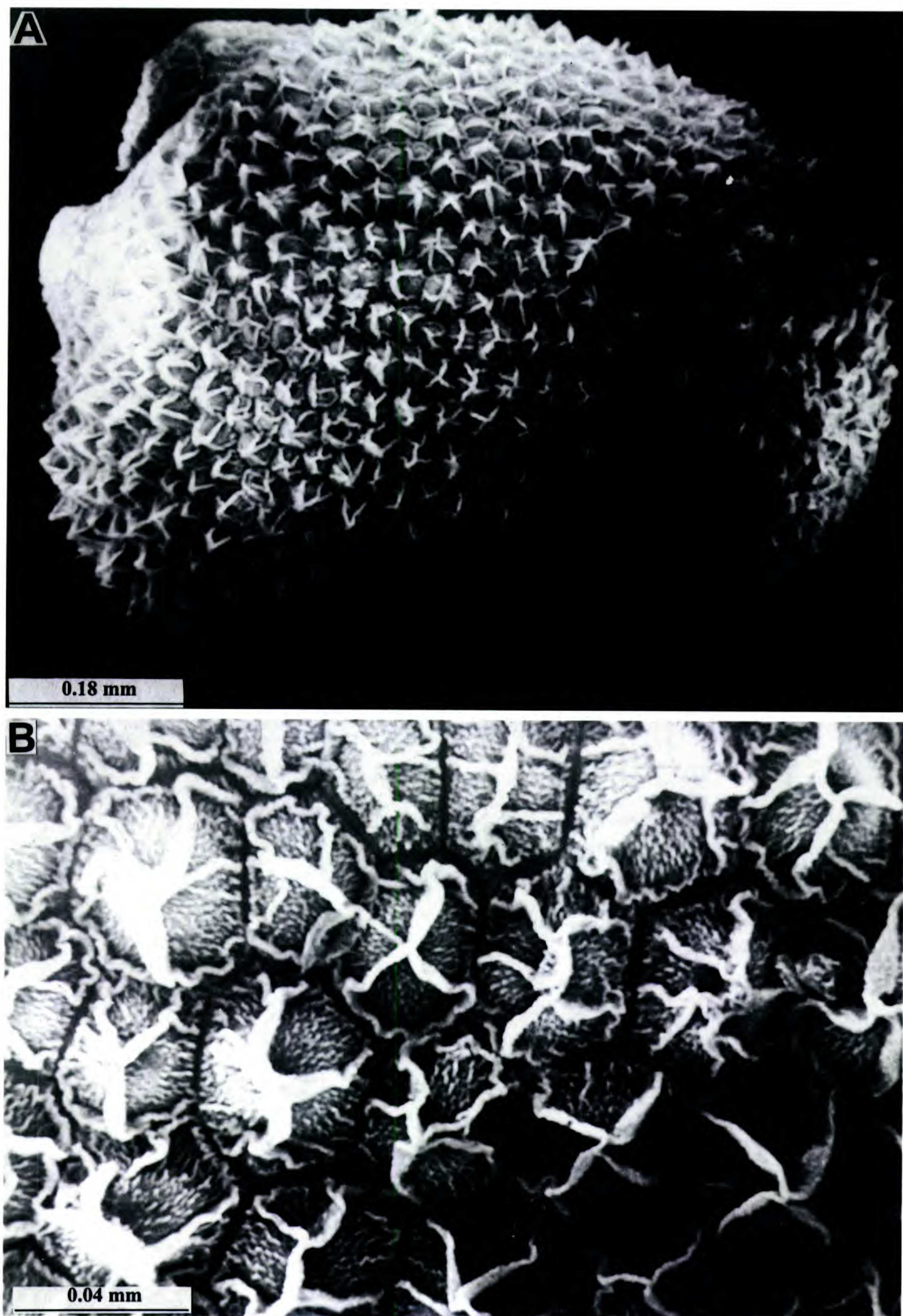


Figure 3. *Hypoxis angustifolia*. —A. Seed. —B. Seed coat sculpture. Both from *Bamps & Malaisse 8052* (BR).



deeply sagittate, retuse at apex, 1.5–3.0 mm long; ovary obconical, 2–5 × 1–3 mm, villous; style 1–3 mm long; stigma 0.7–2.5 mm long, both variable in shape. Capsule turbinate, 7–14 × ca. 3 mm, pubescent, often splitting in three lobes; seeds numerous, ovoid, ca. 2 mm long; cuticle thick, brown; seed coat with pyramidal pointed projections.

*Distribution and ecology.* *Hypoxis angustifolia* is a species with a wide geographical range in intertropical and South Africa and from Madagascar and the Mascarene Islands. It occurs both in undisturbed natural habitats like miombo, dry forests, bush, various types of grasslands, river valleys, lakeshores, and in habitats strongly impacted by human activities like pastures, fallow fields, cultivated stands of manioc, and roadsides. It can be found on different kinds of soils: loamy, with kaolin, rocky, laterite, and on granite slabs; alt. 850–1500 (exceptionally 1900) m. Flowering from January to May and in August. It is the only species of *Hypoxis* in Congo-Kinshasa to occur in the western part of the country (Fig. 21).

*Additional specimens examined.* CONGO-KINSHASA. **Bas-Zaïre:** s. l., Odon in Gillet s.n. (BR); Luki, Wagemans 285 (BR); Bingila, Dupuis s.n. (BR); Lutete, Hens 221 (BR); Mbanza-Ngungu, Breyne 2624 (BR), Lisowski 56805 (BR); Kitobola, Flamigni 297 (BR); Kinkonka, Vanderyst s.n. (BR); Kimpasa, Vanderyst s.n. (BR); Kisantu, Gillet s.n. (BR), Gillet s.n. (BR), Vanderyst 37242 (BR); Pemba, Williams 18 (BR). **Kinshasa:** environ de Kinshasa, vallée de la Lukaya, Lisowski 86119 (BR), Breyne 4711 (BR); Kinshasa, Pauwels 6009 (BR); Kimuenza, Lejoly 82/1013 (BR, BRLU); Lutendele, Jans 98 (BR). **Bandundu:** Chutes Tembo, Breyne 2590 (BR). **Haut-Zaïre:** entre Arumbi et Berunga, Louis 4587 (BR); entre Niangara et Wamba, Lebrun 3256 (BR); Abok, Scops 168 (BR); route Gabu–Golu, Taton 437 (BR); Nioka, Lejoly 3338 (BRLU), Lisowski 48484 (POZG); Parc National Garamba, ca. piste centrale vers 30 km, Noirfalise 826 (BR), Troupin 1308 (BR); piste frontière vers km 15, Troupin 1243 (BR). **Kasai Oriental:** Lomami, Dandoy 206 & 361 (BRLU). **Kivu:** Kikanga, Bequaert 4211 (BR); Katanda, Lebrun 7557 (BR); Kabare, Bequaert 5505 (BR); Beni, Bequaert 3391 (BR); Parc National Virunga, Migeri, Fredericq in de Witte 8741 (BR); Section Vasongora Ouest, au confluent Ihumbia/Semliki, de Wilde 273 (BR); Section Vasongora, en bordure routé Beni–Kasindi, de Wilde 467 (BR); Rwindi, de Witte 13341 (BR); Kombukabakoli, rive droite Semliki, de Witte 11267 (BR); entre Kingi et Nyafuma, Lebrun 7835 (BR); Kibati, Stauffer 500 (BR); Keshero, Crispiels-Thonon 132 (BR). **Shaba:** Tshibonde, Mullenders 2346 (BR); Kapolowe, Lisowski B-7276 & B-7378 (POZG); Lubumbashi, Bamps & Malaisse 8052 (BR), Quarré 5056 (BR); Lusinga, Lisowski, Malaisse & Symoens 10710A (POZG); Kumanua, Bamps & Malaisse 8278 (BR), Malaisse 8988 (POZG); vallée de Kipiri, Homblé 1091 (BR); Plateau des Marungu, Pepa, Lisowski, Malaisse & Symoens 9557 l (POZG); Parc National Upemba, de Witte 7508 (BR). RWANDA. Parc National de l'Akagera, Bouxin & Radoux 434 (BR); environ Gabiro, Troupin 14109 (BR); Gabiro, Burgeon 17 & 34 (BR); Ki-

bugabuga, Liben 620 & 1231 (BR), Van Oosten 120 (BR); Nemba, Bouxin & Radoux 1415 (BR); Bugesera, Augier 2898 (BR); Matinza, Bouxin & Radoux 1008 (BR); Lulama, Bouxin & Radoux 418 (BR); Mimuli, Troupin 4230 (BR); Lukionji, Troupin 6776 (BR); Kakitumba, Christiaensen 736 (BR). BURUNDI. Route Bubanza–Musigati, Lewalle 4189 (BR); Bujumbura, Lewalle 5486 (BR, MO); plaine de la Ruzizi, Germain 6086 & 6237 (BR), Reekmans 2906 (BR, MO); Bulamata, Germain 7191 (BR); Rumonge, Lewalle 5029 (BR).

*Vernacular name.* Nyabokela (dialect Kinyarwanda); Dioko di ngumbi (a partridge tuber, dialect not stated, from Gillet & Pâque, 1910).

The name *H. angustifolia* was used for some time in Central Africa as the name for all species with leaves less than 7 mm wide (Geerinck, 1971). This species is indeed characterized with a great morphological variability, especially in shapes of style and stigma. It differs from all species of *Hypoxis* in an occasional red striping on the tepals, not observed in any other species. In tropical Africa its seeds are always brown and covered with thick cuticle (Fig. 3). Its membranous tunic and seeds distinguish it from *H. malosana*, a species with fibrous tunic and black seeds (Fig. 16). *Hypoxis dinteri*, which bears seeds similar to *H. angustifolia* (Fig. 7), differs in its fibrous tunic and ensiform leaves (Fig. 6C), while leaves of the latter species are linear. *Hypoxis kilimanjarica* possesses black seeds (Fig. 12A) and pedicels not exceeding 6 mm (Fig. 11A), while those of *H. angustifolia* are usually at least 12 mm long. More robust, but similar to *H. angustifolia*, *H. malaissei* bears a partially fibrous tunic and black honeycombed seeds (Fig. 14B). *Hypoxis monanthos* differs in its partially fibrous tunic and bending scapes with pedicels to 5 mm long (Fig. 11C). Scapes of *H. angustifolia* are rigid. *Hypoxis muhilensis* is a species similar to *H. angustifolia* in its loose inflorescence, sparsely pilose linear leaves, and brown seeds, which have a similar sculpture in *H. muhilensis* subsp. *kansimbensis* (Fig. 2C), but quite different in the typical subspecies (Fig. 17). Moreover, *H. muhilensis* possesses a fibrous tunic and is a much more robust plant. *Hypoxis upembensis* shares similar seeds (Fig. 20C, D) and indumentum with *H. angustifolia* (Fig. 18H, I), but is easy to distinguish thanks to its partially fibrous tunic, 5 mm wide outer tepals, and pedicels to 6 mm long (Fig. 6E). Tepals of *H. angustifolia* do not exceed 4 mm in width.

*Hypoxis angustifolia* is a medicinal plant with a pulp from the rhizome used for healing pustules and infected wounds (Gillet & Pâque, 1910).





Figure 4. Habit of *Hypoxis bampsiana* from Lisowski 7653 (POZG).

**3. *Hypoxis bampsiana*** Wiland, Bull. Jard. Bot. État. 66: 207. 1997. TYPE: Congo-Kinshasa. Shaba: "Plateau des Kundelungu, au bord de la rivière Lofoi," alt. 1500 m, Oct. 1969, Lisowski, Malaisse & Symoens 7653 (holotype, POZG!). Figures 4, 5A, B.

*Herb* to 45 cm high; *rhizome* ovoid, ca. 5.5 × 4.5–6.0 cm (dried out); tunic membranous and fibrous, to 8 cm. *Outer leaves* 4 to 7, ovate, cuspidate, keeled and reflexed, (1.3–) 5.0–18.0 × (1–) 3–5 cm, tomentose below, glabrous above; trichomes tufted, golden, longer on margins and midrib; ner-

vation with 65 to 105 unequal nerves; *inner leaves* 6 to 7, ovate or lanceolate, cuspidate, slightly keeled, erect or slightly reflexed, (12–) 17–45 (–56) × 3.0–7.0 (–7.6) cm, tomentose below, glabrous above; trichomes tufted, golden, longer on margins and midrib, midribs tufted, ca. 13-branched with branches varying 0.2–1.6 mm; nervation with 95 to 191 unequal nerves. *Scapes* 6 to 9, 14.5–30 cm × (2–) 3–4 mm, short winged and ciliate in lowest 2/3, wider and tomentose in apical 1/3; trichomes tufted, ca. 9-branched, branches 0.2–3.5 mm long; *raceme* 6- to 14-flowered, floral an-



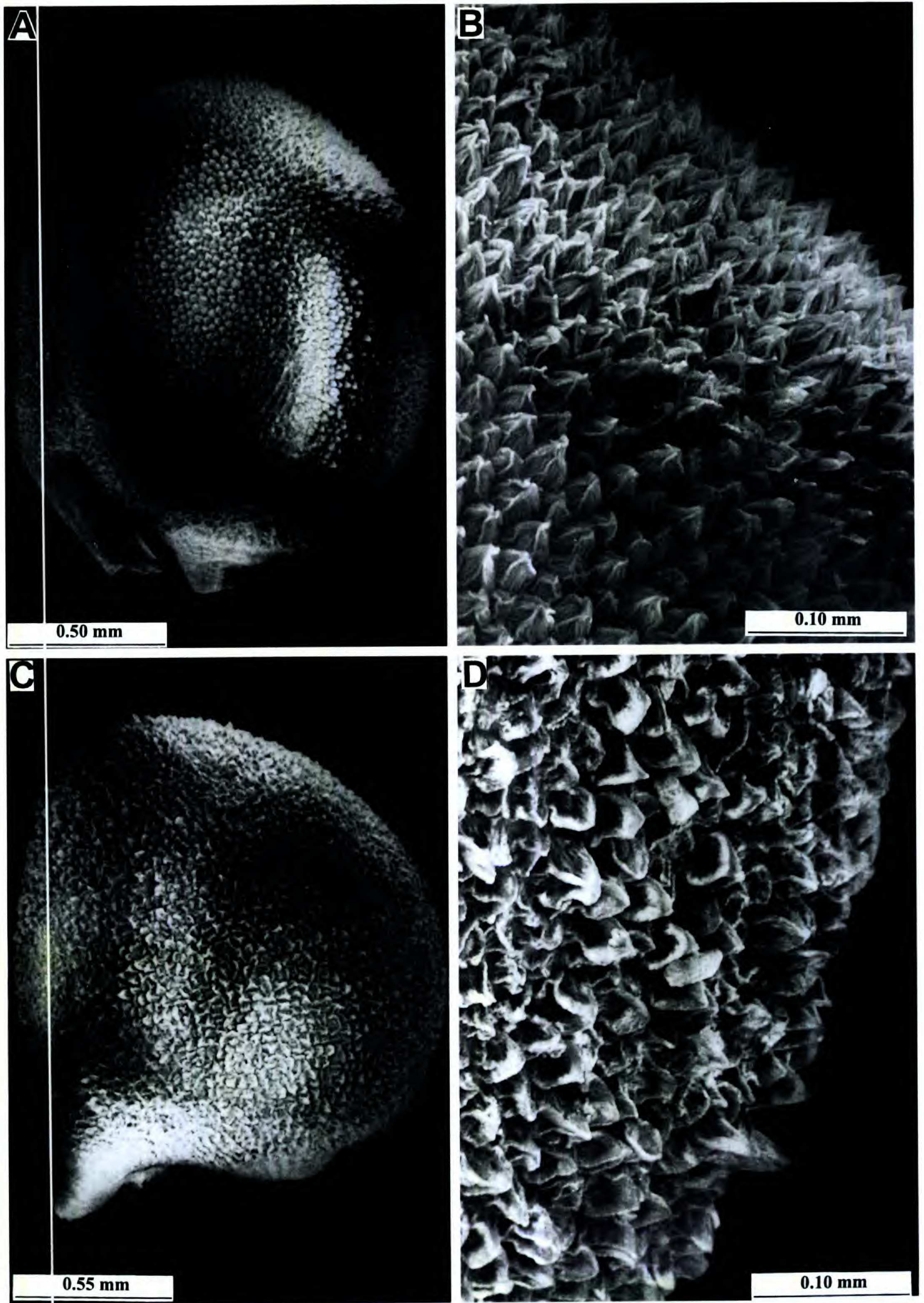


Figure 5. A, B. *Hypoxis bampsiana*. —A. Seed. —B. Seed coat sculpture. C & D. *Hypoxis goetzei*. —C. Seed. —D. Seed coat sculpture. A and B from *Lisowski 1009* (POZG); C and D from *Lisowski 7492* (POZG).



thesis acropetal; *bracts* subulate, acute, keeled, 1–2 cm × 1.5–4.0 mm, lowermost 5-nerved, hairy on midrib and nerves abaxially; *pedicels* 0.4–2.3 cm long, tomentose. *Tepals* 6; *outer tepals* oblong, slightly keeled, 14–15 × 5.5–6.0 mm, abaxially pubescent, ± regularly 9- to 14-nerved; appendage clavate, 1 mm long; *inner tepals* wide ovate, obtuse, with margins inflexed below apex, ca. 13 × 7–8 mm, with ca. 11 irregular nerves, pubescent abaxially along midrib on lowest 1/3; *stamens* equal, ca. 8 mm long; *filaments* ca. 5 mm long; *anthers* linear, prominently sagittate, emarginate at apex, 5–6 mm long; *ovary* obconical, pubescent, 6–10 × 3–5 mm; *style* trigonous, 1–3 mm long; *stigma* pyramidal, obtuse, ca. 2 mm long, of three linear papillate surfaces. *Capsule* turbinate, 4–10 × 4–8 mm, pubescent; *seeds* numerous, ovoid, 1 mm diam.; cuticle thick, brown; seed coat bristly with pointed pyramidal projections winged with cuticle.

*Distribution and ecology.* Congo-Kinshasa (Fig. 22), Zambia. Montane grassland, wooded grassland, woodland; miombo; on sandy soils; alt. 1250–1650 m. Flowering January and October. Inflorescences are produced simultaneously or after inner leaves.

*Additional specimens examined.* CONGO-KINSHASA. **Shaba:** Plateau des Kundelungu, *Lisowski, Malaisse & Symoens 737 & 7615* (POZG); entre les rivières Petite Lofoi et Kalembe, *Lisowski, Malaisse & Symoens 12947 & B-7279* (POZG); au bord de la rivière Kalembe, *Lisowski, Malaisse & Symoens 12830, 12853 & 12859* (POZG); près du gîte RACK, *Lisowski, Malaisse & Symoens 1009* (POZG).

*Hypoxis bampsiana* is closely related to sympatric *H. goetzei*. Both species possess ovate leaves, very similar brown seeds (Fig. 5), and golden tufted trichomes (Fig. 8H–J), but of a different distribution on the leaves. Leaves of *H. bampsiana* are covered with indumentum on the whole laminal surface below (Fig. 4), whereas leaves of *H. goetzei* are only ciliate on margins and midrib below. The most distinctive difference is observed in the inflorescence types. Inflorescences of *H. bampsiana* are racemose, with floral anthesis being acropetal, whereas cymes of *H. goetzei* are characterized by basipetal anthesis. This distinguishes these two species even without leaf material, which is an important character, because *H. goetzei* often develops flowers before leaves.

**4. *Hypoxis canaliculata*** Baker, Trans. Linn. Soc. ser. 2, Bot. 1: 265. 1878. TYPE: Angola. Huilla: “regio subtemperata, in pascuis collinis arenosis prope Lopollo, frequens,” *Welwitsch 4057* (holotype, BM!). Figure 6A.

*Herb* to 9–15 cm high; *rhizome* subglobose 14–24 mm (dried out); tunic to 4–6 cm, fibrous and membranous; roots not very thick. *Outer leaves* ca. 2, canaliculate, ca. 4 cm × 1 mm, villous below; trichomes tufted, white; nerves 7, unequal; *inner leaves* ca. 3, canaliculate, 4.5–15.0 cm × 1 mm, prominently villous on margins and midrib below; trichomes tufted, white, with branches falling off, so on old leaves only simple and 2-branched trichomes occur; nerves 7, unequal. *Scapes* 2 to 8, 2.5–5.0 cm × 0.5 mm, villous with white tufted trichomes; *flowers* single or two; *bracts* subulate, acute, 3 × 0.3 mm, villous abaxially; *pedicels* to 8 mm long, villous. *Tepals* 6; *outer tepals* lanceolate, ca. 10 × 2 mm, villous abaxially with tufted trichomes, 7-nerved; *inner tepals* lanceolate, acute, 9 × 1.5 mm, villous along midrib abaxially, irregularly 5-nerved; *stamens* unequal; outer stamens ca. 5 mm long with filaments ca. 3 mm long; inner stamens ca. 3 mm long with filaments ca. 1 mm long; *anthers* linear, sagittate, 3 mm long, fused at apex; *ovary* obconical, 3–4 × ca. 2.5 mm wide, villous; *style* tapering toward apex, ca. 2 mm long; *stigma* pyramidal, acute at apex, composed of three stripes of papillae, 2.5 mm long. *Capsule* subglobose; *seeds* ovoid, black; seed coat almost smooth, glittering, dotted, and with small papillae near apex.

*Distribution and ecology.* Congo-Kinshasa (Fig. 27), Angola, Zambia, Malawi, Zimbabwe. Grassland areas; alt. 1350 m. Flowering in November (in Angola, December to January, *Baker 1878a*).

*Additional specimens examined.* CONGO-KINSHASA. **Shaba:** Domain de Muhila, près du village Baton, *Lisowski 81123* (POZG). ZAMBIA. Mbala [= Abercorn]. *Fries 1275* (UPS).

*Hypoxis canaliculata* was originally described from Angola and subsequently collected in Zambia (Fries, 1916; Richards & Morony, 1969), Zimbabwe (Norlindh & Weimarck, 1937), and Malawi (Binns, 1968), but never before has it been reported from Central Africa. *Hypoxis canaliculata* shares its canaliculate leaves with *H. filiformis*, but has 1 mm wide leaves and a fibrous tunic (Fig. 6A). Leaves of *H. filiformis* are 0.7 mm wide, filiform, and the tunic is membranous with only a few soft fibers (Fig. 6D). *Hypoxis canaliculata* is similar in appearance to *H. symoensiana* (Fig. 6B), but differs in black seeds with a thin cuticle, which are not brown and covered with a thick cuticle as in the latter species (Fig. 20A). Because few collections are known, more studies will be needed to determine its taxonomic position and relationships to other species.



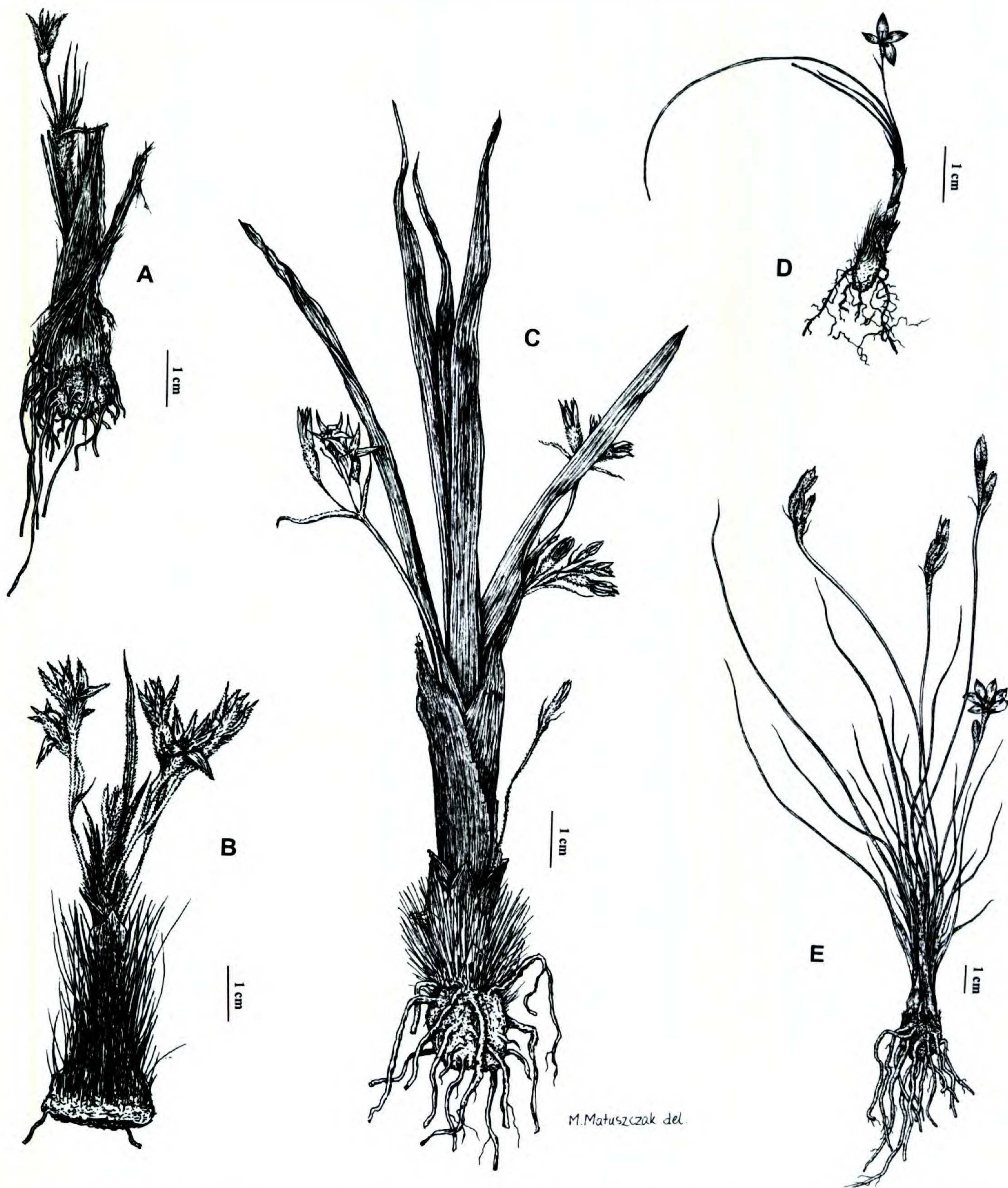


Figure 6. Habit. —A. *Hypoxis canaliculata* (Lisowski 81123, POZG). —B. *Hypoxis symoensiana* (Lisowski, Malaisse & Symoens 12058, POZG). —C. *Hypoxis dinteri* (Bulaimu 58, BR). —D. *Hypoxis filiformis* (Niyongere 95, BR). —E. *Hypoxis upembensis* (de Witte 3698, BR).

5. ***Hypoxis dinteri*** Nel, Bot. Jahrb. Syst. 51: 302. 1914. TYPE: Namibia. Damaraland: Otavital, Jan. 1909, *Dinter* 634 (holotype, B!). Figures 6C, 7A, B.

*Herb* to 22 cm high; *rhizome* ovoid, 0.7–1.3 cm diam. (dried out); *tunic* fibrous, 1.5 cm high. *Outer leaves* 2 to 3, ovate, 1.5–11.0 cm × 8–20 mm, cil-

iate on margins and midrib below; trichomes 2-branched, golden, long; nerves 9 to 19, unequal; *inner leaves* 3 to 5, ensiform, sometimes keeled, 7–22 cm × 6–8 mm, long hispid on margins and midrib below and pilose on entire surface with golden 2-branched trichomes; nerves 21 to 25, unequal. *Scapes* 2 to 4, 4.5–10.5 cm × 1 mm wide, narrowly winged at base, above ciliate, pubescent apically;



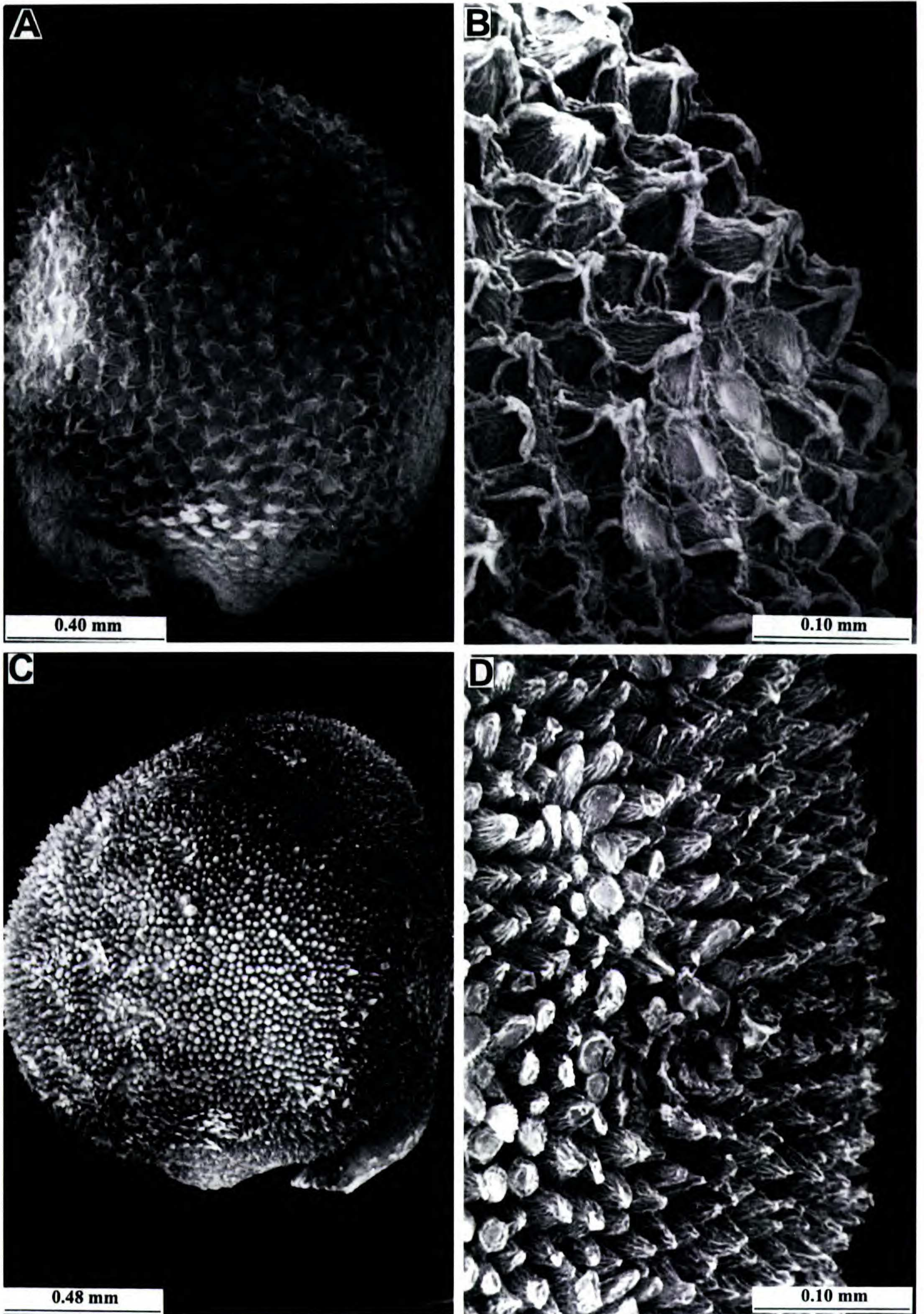


Figure 7. A, B. *Hypoxis dinteri*. —A. Seed. —B. Seed coat sculpture. C & D. *Hypoxis lusalensis*. —C. Seed. —D. Seed coat sculpture. A and B from *Detilleux 229* (BR); C and D from *Lisowski, Malaisse & Symoens 8300* (POZG).



cyme corymbiform, 2- to 4-flowered; *bracts* subulate 4.5–15.0 × 1 mm, pubescent along nerves abaxially with 2-branched trichomes, ciliate in apical part with simple trichomes, the lowermost larger than the upper; *pedicels* 6–14 mm long, pubescent. *Tepals* 6; *outer tepals* elliptic, 5–7 × 2–3 mm, pubescent abaxially; nerves 5 to 7, irregular; *inner tepals* ovate, acute, 5–7 × ca. 3 mm, pubescent along midrib adaxially; nerves 5 to 7, irregular; *stamens* equal, 3–4 mm long; *filaments* 2.0–2.5 mm long; *anthers* oblong, 1.7–2.0 mm long, sagittate, retuse at apex; *ovary* obconical, 3–5 × ca. 2–3 mm, pubescent; *style* trigonous, 2–3 mm long; *stigma* pyramidal with three strips of papillae, obtuse at apex, 1–2 mm long. *Capsule* obovoid, 7–8 × 2.5–3.0 mm, pubescent; *seeds* numerous, ovoid, ca. 1.3 × 1 mm; cuticle thick, dark red-brown; seed coat bristly with pointed projections.

*Distribution and ecology.* Congo-Kinshasa (Fig. 27), Zambia, Namibia. Occurs in miombo; natural pasturage, dembo; on gritty yellow soil; alt. ca. 1250 m. Flowering from November to December.

*Additional specimens examined.* CONGO-KINSHASA. **Shaba:** A 11 km au NW de Lubumbashi, *Bulaimu* 58 (BR); Keyberg, *Detilleux* 229 (BR); Mokambo–Tela, km 10, riv. Tshinshimuka, *D'Hose* 48 (BR). ZAMBIA. **Kitwe:** 7 mi. N of Kitwe, 1275 m, 14.11.161, *K. Linley* 212 (MO).

*Hypoxis dinteri* was until now only known from the type location in Namibia. The plants on the holotype sheet are single-flowered, possessing one or two bracts. Two bracts are often noted on single flowers in other species. For example, *H. kilimanjarica* and *H. monanthos* may bear two or one flower with two bracts due to degeneration of one bud. In contrast, specimens from Congo-Kinshasa have 2 to 4 flowers (Fig. 6C). Quite unique ensiform leaves (Fig. 6C) entirely covered with 2-branched golden trichomes and a fibrous tunic indicate, however, that this is the same species. A corymbiform cyme and brown seeds of *H. dinteri* (Fig. 7A) make this species similar to *H. angustifolia* (Fig. 3), but the latter species bears a membranous tunic and linear leaves.

**6. *Hypoxis filiformis*** Baker, J. Linn. Soc., Bot. 17: 109. 1878b. TYPE: South Africa. Queens-town, 1860, *Cooper* 462 (holotype, K!; isotype, B!). Figure 6D.

*Herb* to 10 cm high; *rhizome* cylindrical, 1.2 × 0.7 cm (dried out); tunic black, membranous with some light-colored, soft fibers, to 1.5 cm long. *Outer leaves* 2, ca. 6 mm wide, cuspidate, much shorter than inner leaves, glabrate; *inner leaves* 3 to 4, basally subulate, above filiform and canaliculate, 3.2–

16.0 cm × ca. 0.7 mm wide, erect or bending backward, 3-nerved, glabrate with a few 2- to 3-branched light-colored trichomes on nerves in basal part of lamina below. *Scapes* 1 to 4, to ca. 5 cm × ca. 0.3 mm, basally wider, widely winged, ciliate, pubescent in the upper half with 2- to 3-branched trichomes; *flowers* solitary; *bracts* subulate, ca. 4 × 1 mm at base, pubescent on the midrib abaxially; *pedicels* 3.0–4.5 mm long, pubescent. *Tepals* 6 or 4; *outer tepals* elliptic, ca. 6 × 2 mm, pubescent abaxially especially along the midrib with 2- to 3-branched trichomes, 5-nerved; *inner tepals* elliptic, obtuse, ca. 5 × 2 mm, pubescent abaxially along midrib, 5-nerved; *stamens* 4, unequal; outer stamens ca. 3 mm long with filaments ca. 2.5 mm long; inner stamens ca. 2.5 mm long with filaments ca. 1.5 mm long; *filaments* subulate, distinctly tapering apically; *anthers* sagittate, fused at apex, ca. 1 mm long; *ovary* obconical, ovoid after flowering, ca. 3.5 × 1 mm, prominently pubescent; *style* terete, ca. 1 mm long; *stigma* composed of 3 free lobes, less than 1 mm long. *Capsule* and *seeds* not seen.

*Distribution and ecology.* Burundi (Fig. 27), Lesotho, South Africa. Rocky and wet grassland. Flowering in January in Burundi.

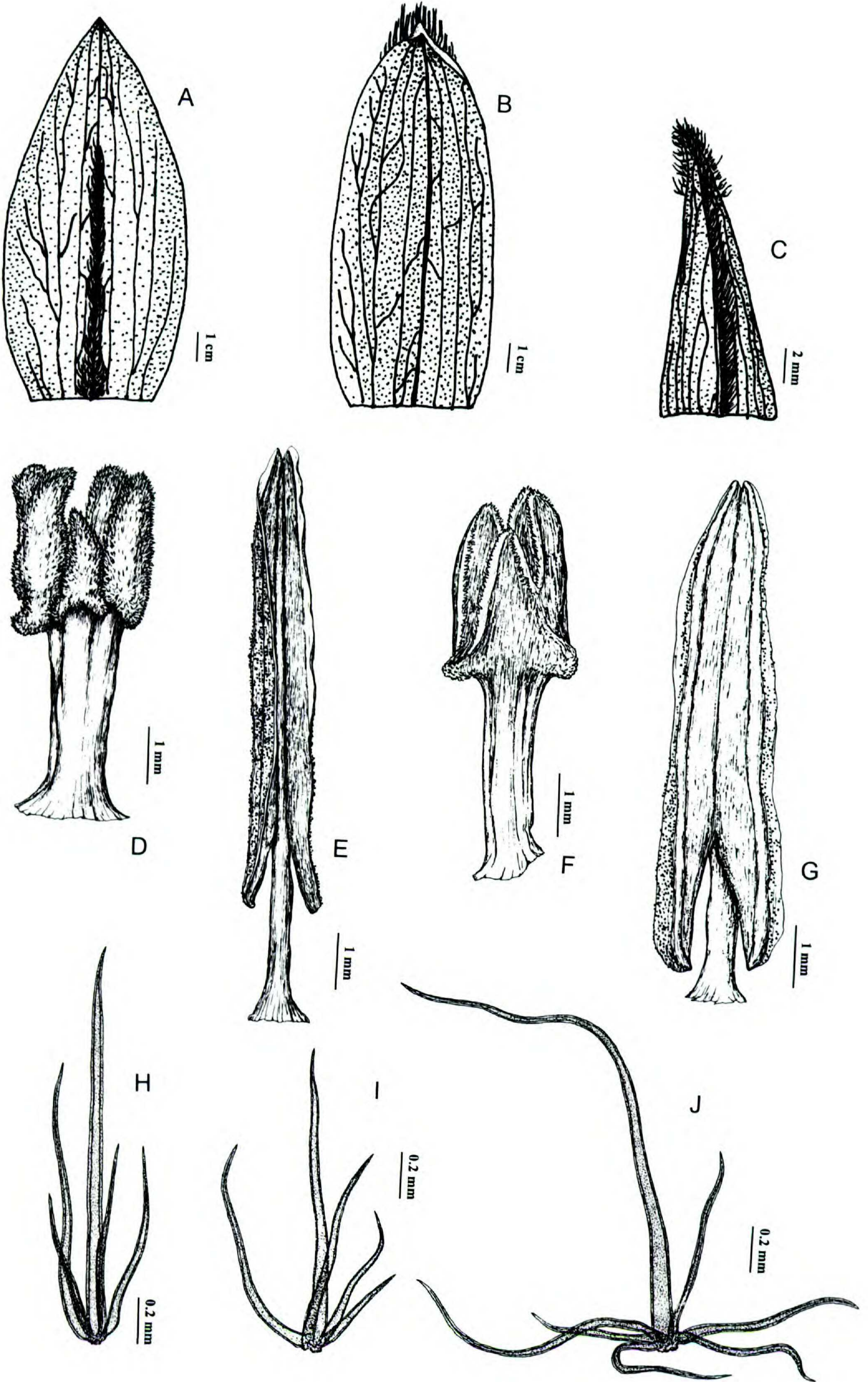
*Additional specimen examined.* BURUNDI. Territory Mwaro: Nyamiyaga près de Kisozi, alt. 2150 m, *Niyongere* 95 (BR).

*Hypoxis filiformis* was confused in the past with *H. malosana* (De Wildeman, 1921; Zimudzi, 1996). However, these two species differ noticeably. *Hypoxis filiformis* bears a mainly membranous tunic with few soft fibers and filiform, canaliculate inner leaves only 0.7 mm wide. *Hypoxis malosana* possesses a prominent fibrous black tunic and flat or carinate leaves 1–3 mm wide.

Hilliard and Burt (1983) described *H. tetramera*, which differs from *H. filiformis* in possessing only 4 tepals and retuse anthers. Such retuse anthers were described as well in *H. sagittata* Nel (1914b), who also mentioned that some flowers have 4 tepals. The Central African plant bears 4-tepaled flowers as well (Fig. 6D), but with fused anthers. The single character of fused or retuse anther apices does not appear to be a satisfactory basis for separating these three species, but this problem will have to be studied in South Africa, where they all are sympatric. So far, for the Burundi plant I decided to use the oldest name.

In Central Africa *H. filiformis* is most similar to *H. kilimanjarica* subsp. *kilimanjarica*. Some plants of the latter bear carinate leaves about 1 mm wide, so they look very similar to canaliculate leaves of







the former. Moreover, flowers of *H. kilimanjarica* are sometimes 4-tepaled. Usually, however, inner leaves of *H. kilimanjarica* are at least 2 mm wide with 9–13 nerves (Fig. 11A), while inner leaves of *H. filiformis* are only 0.7 mm wide and 3-nerved.

**7. *Hypoxis goetzei*** Harms, Bot. Jahrb. Syst. 30: 276. 1901. TYPE: Tanzania. "Unyika, bei Dorf Toola, um 1300 m ü. M.," 8 Nov. 1899, *Goetze 1416* (holotype, B!; isotypes, BM!, BR!). Figures 5C, D, 8, 13C.

*Hypoxis rubiginosa* Nel, Bot. Jahrb. Syst. 51: 320. 1914. TYPE: Mozambique. "Unteres Mgaka-Tal, um 1200 m ü. M.," Jan. 1901, *Busse 947* (holotype, B!).

*Hypoxis esculenta* De Wild., Repert. Spec. Nov. Regni. Veg. 11: 537. 1913. TYPE: Congo-Kinshasa. Ober-Katanga, 1911, *Hock s.n.* (holotype, BR!).

*Herb* to 41 cm high; *rhizome* subglobose, 3.2–5.7 cm diam. (dried out); tunic fibrous, black, to 9 cm. *Outer leaves* 3 to 7, ovate, cuspidate, older slightly keeled and reflexed, 5.0–12.2 (–15.0) × 2–5 cm, ciliate on the margins and midrib below, glabrous above; trichomes tufted, brown or dark golden; nerves unequal, 31 to 69; *inner leaves* 6 to 8, long elliptic or sword-shaped, acute, entire or sometimes with very small teeth, erect, sometimes keeled, (7.5–) 11.0–30.5 (–41) × (0.8–) 2.0–5.0 (–7.0) cm, ciliate on margins and midrib below, glabrous above; trichomes tufted, ca. 5-branched, brown or dark golden; nerves unequal, 27 to 91. *Scapes* 1 to 8, 8.0–25.5 cm × 2.5–5.0 mm, ciliate in lowest 1/3, prominently tomentose in apical 2/3; trichomes tufted, ca. 7-branched with branches 0.6–2.3 mm long, getting darker and falling off with age; *cyme* 4- to 14-flowered, floral anthesis basipetal; *bracts* widely subulate, keeled, (5–) 7–17 × 1–4 mm, the lowermost 5- to 7-nerved, hairy on the midrib abaxially, ciliate on margins in apical part; *pedicels* 6–10 mm long, on young flowers in the basal part of inflorescence almost none. *Tepals* 6; *outer tepals* ovate or lanceolate, keeled, 10.5–18.0 × 4–6 (–7) mm, abaxially pubescent; nerves irregular 5 to 9; *inner tepals* ovate, acute, with margins inflexed below apex, 10–17 × (4–) 5–8 (–9) mm; pubescent abaxially along the midrib on lower 2/3; nerves irregular, (5) 7 to 9; *stamens* equal, 6–10 mm long; *filaments* subulate, 3.0–4.5 mm long; *anthers* prom-

inently sagittate, slightly emarginate or fused at apex, 4–7 (–8) mm long; *ovary* obconical, (3–) 6–7 (–9) × 3–6 (–7) mm, pubescent; *style* often tapering toward base, 2.5–4.0 mm long; *stigma* (1.2–) 2.0–3.0 (–4.0) mm long, composed of three free lobes variously covered with papillae. *Capsule* turbinate, 4–10 × (3–) 4–6 mm, pubescent; *seeds* ca. 12, globose or almost ovoid, 1.2–1.5 × 1.2–1.5 mm, brown; cuticle thick; seed coat bristly with pointed pyramidal projections winged with cuticle.

*Distribution and ecology.* Congo-Kinshasa (Fig. 26), Kenya, Tanzania, Zambia, Zimbabwe, Mozambique. Grassland and wooded grassland, on plateaus or in river valleys, near springs; in miombo with *Brachystegia boehmii* Taub. On dry to swampy ferrallit, eolith, sometimes very compact soils; alt. 1200–1830 m. Flowering from August to November.

*Additional specimens examined.* CONGO-KINSHASA. **Kivu:** source de la rivière Kipese, *Plancke 63/911* (BRLU). **Shaba:** 20 km SO d'Lubumbashi, *Schmitz 4803* (BR); Luiswishi, *Malaisse 13696* (BR); 28 km au NE de la Lubumbashi, *Bulaimu 715* (BR); Kasonta, *Schmitz 7499* (BR); route entre Mitwaba et Kiubo, *Duvigneaud & Timperman 2731* (BR); Mitwaba, *Duvigneaud & Timperman 2700* (BR), *Mortelmans 89* (BR); Katuba, *Quarré 704* (BR, MO), *921* (BR); Dilolo, 10 km au N de la forêt de la plateau à *Marquesia*, *Duvigneaud & Timperman 2400* (BRLU); Kansenia, *de Witte 4* (BR); Lubudi, *Quarré 3416* (BR); vallée de la Dikuluwe, *Hock s. n.* (BR); route Kabisha–Kasomeno, près du village Bowa, *Lisowski 50994* (POZG); vallée de la Luapula, près de Kiniana, *Lisowski B-7270* (POZG); Plateau des Marungu, Mulongoshi, *Quarré 7252* (BR); 7 km au NW de Pepa, *Lisowski, Malaisse & Symoens 8665* (POZG); Kibobwa, 1 km au S de Mukunda, *Lisowski, Malaisse & Symoens 8669* (POZG); Mont Kibobwa, près du village Kibobwa, *Lisowski, Malaisse & Symoens 11798* (POZG); Plateau de Bianco, Dilungu Yulu, *Duvigneaud & Timperman 2627* (BRLU); Grelco, *Quarré 6035* (BR); Parc National de L'Upemba, entre Kabwe Kanono et Mukana, *de Witte 4406* (BR); entre Lusinga [= Mitwaba] et Kabwe Kanono, *de Witte 7364* (BR); Lusinga, *de Witte 2714* (K) & *Robyns 3587* (BR); vers tête de source Kalumengongo, *de Witte 7451* (BR); tête de la source de la Mukelengia, *de Witte 7307* (BR); près rivière Dipidi, *de Witte 2809* (BR); Plateau des Kundelungu, *Lisowski, Malaisse & Symoens 7492* (POZG), *Lisowski 81107* (POZG); au bord de la rivière Lofoi, *Lisowski 7655* (POZG); Tilwizembe, *Plancke 127-1741* (BRLU).

*Hypoxis goetzei* is a useful plant with an edible rhizome. De Wildeman (1913) described this spe-

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Figure 8. *Hypoxis goetzei*. —A. Dorsal view of inner tepal. —B. Ventral view of outer tepal. —C. Dorsal view of bract. —D & F. Morphological variability of stigmas. —E, G. Stamen (E dorsal view, G ventral view). —H. Tufted trichome from a leaf midrib. —I. Tufted trichome from a leaf edge. —J. Tufted trichome from a scape. A and B from *Lisowski, Malaisse & Symoens 8665* (POZG); C from *Schmitz 7499* (BR); D and E from *Lisowski B-7270* (POZG); F, G, H, I, and J from *Lisowski, Malaisse & Symoens 11798* (POZG).



cies for Congo-Kinshasa as *H. esculenta*. *Hypoxis goetzei* was confused by some authors (De Wildeman, 1914; Geerinck, 1971) with *H. subspicata*. Both species have basipetal floral anthesis but they differ in leaf shape and indumentum both on vegetative and reproductive organs. *Hypoxis goetzei* possesses long elliptic or sword-shaped inner leaves, ciliate only on the margins and midrib below. Whereas *H. subspicata* bears linear leaves entirely covered with indumentum below, indumentum of *H. goetzei* is golden, and that of *H. subspicata* white. Seeds of both species are covered with thick cuticle (Figs. 5C, D, 10 A, B). *Hypoxis goetzei* is probably most closely related to *H. bampsiana*. Both species possess similar seeds (Fig. 5), indumentum of brown or golden rather short tuft hairs (Figs. 8H–J, 13C), and appearance, but leaves of *H. bampsiana* are entirely covered with indumentum below. Cymes of *H. goetzei* are characterized by basipetal anthesis, whereas racemes of *H. bampsiana* are with acropetal floral anthesis. This distinguishes these two species even without leaf material, a character worth noticing, because *H. goetzei* often develops flowers before leaves. Bracts of *H. goetzei* are often ciliate (Fig. 8C), which is uncommon in both other mentioned species.

**8. *Hypoxis hockii*** De Wild., Repert. Spec. Nov. Regni. Veg. 11: 537. 1913. TYPE: Congo-Kinshasa, "Ober-Katanga," 1911, *Hock s.n.* (syntypes, B!, BR!).

*Hypoxis pedicellata* Nel ex De Wildeman, Bot. Jahrb. Syst. 51: 320. 1914. TYPE: Democratic Republic of Congo, "Lualaba," 1891, *Deschamps s.n.* (holotype, BR!).

*Herb* to 78 cm high; *rhizome* cylindrical or ovoid, 2.7–3.5 cm diam. (dried out); tunic fibrous, stiff, to 25 cm. *Outer leaves* 2 or 3, linear, elliptical or oblong, keeled, 3–20 × 1–5 cm, pubescent on both surfaces or only below; nerves unequal, 17 to 39; *inner leaves* 3 to 15, linear, narrowing toward the apex, keeled, 10.5–78.0 (–102.0) × 0.8–2.0 cm, densely villous on the whole surface or prominently villous on margins and midrib below and only sparsely pubescent on the lamina; nerves unequal, 11 to 39. *Scapes* 3 to 12, 7–34 (–50) cm × 2–4 mm, thickened beneath inflorescence, winged and ciliate at base, villous apically with long white or golden tufted trichomes; *raceme* 6- to 13-flowered, floral anthesis acropetal; *bracts* subulate, keeled, the lowermost 7–22 × 1–2 mm, 1- or 3-nerved, villous on the midrib abaxially; *pedicels* 2–20 mm long, prominently villous. *Tepals* 6, yellow or orange-yellow; *outer tepals* ovate or elliptic, (9–) 10–16 × (3–) 4–6 mm wide, densely hispid abaxially,

5- to 9-nerved; *inner tepals* ovate, shortly cuspidate or obtuse at apex, (8–) 10–15 × (5–) 6–8 mm, abaxially pilose on midrib, 5- to 7 (to 9) -nerved; *stamens* about 5–10 mm long; *filaments* subulate or almost linear, 3.5–4.5 mm long; *anthers* linear, sagittate, fused or retuse at apex, 4–8 mm long; *ovary* obconical, 3–9 × (2–) 3–5 mm, densely pilose; *style* terete or trigonous 1.0–5.0 mm long; *stigma* 1–4 mm long, composed of 3 linear lobes fused to apex or 3 free triangular lobes with papillae on margins. *Capsule* turbinate, (4–) 5–9 × 3–5 mm, pubescent; *seeds* several, ovoid or spherical, 1.5–2.0 × 1.0–1.5 mm, black; seed coat variously papillate.

*Distribution and ecology.* *Hypoxis hockii* is known only from Congo-Kinshasa (Figs. 25, 27) and Zambia. It occurs in miombo, grasslands, and dry forest, on sandy-loamy soil; alt. 1200–2000 m. Flowering from July to August and from October to November.

*Hypoxis hockii* was included in the synonymy of *H. subspicata* (Geerinck, 1971). There are, however, features that distinguish these two species quite well. First, flower anthesis of *H. hockii* is acropetal, whereas that of *H. subspicata* is basipetal. Second, inner leaves of *H. hockii* are totally covered with trichomes and their nerves are distinct one from another. Inner leaves of *H. subspicata* have indumentum below only and approximate nerves. Moreover, seeds of the first species are black (Fig. 10C–F) and covered with a thin cuticle, while those of the second are brown and covered with a thick cuticle (Fig. 10A, B). *Hypoxis hockii* is also similar to *H. angolensis*, but inner leaves of the latter species have approximate nerves and are only ciliate. Trichomes on the margins and midrib of leaves and from scapes of *H. hockii* (Fig. 9E, F, I, J) possess usually more branches than trichomes of *H. angolensis* (Fig. 1E, F). Seeds of both species are black, but the seed coat sculpture differs (Figs. 2A, B, 10C–F). Another species that bears resemblance to *H. hockii* is *H. robusta*. These two species differ in seed coat sculpture (Figs. 10C–F, 14C, D) and in the shape of inner tepals, which are obtuse or cuspidate in *H. hockii* and acuminate in *H. robusta*. Moreover, flowers of the former are usually accompanied by the inner leaves, whereas in the latter, flowers always appear long before inner leaves, and only outer leaves can be seen with them, if any persist.

*Hypoxis hockii* is a species characterized by great variability. Although all plants are rather similar in appearance, their indumentum density, seed coat sculpture, and floral features like stigma shape or



filaments vary greatly (Fig. 9). The seed coat sculpture is its most distinctive feature. Plants of almost equivalent stature can bear very different seeds (Fig. 10C–F). I decided to stress this observed seed heteromorphism by designating three varieties. Less dense indumentum of the leaves of *H. hockii* var. *katangensis*, compared with other varieties, is a helpful feature in its delimitation as well. However, because of still insufficient material and lack of field studies, it is not possible to decide how this observed variation is distributed in this species. In my opinion, there are not enough differences to apply a subspecies rank to the delimited groups; still I think that the existing ones are worth varietal emphasis.

- 1a. Seed coat colliculate; outline of cells clearly visible; cell boundaries channeled; outer periclinal walls flat, micro-papillate .....  
..... 8b. *H. hockii* var. *colliculata*
- 1b. Seed coat bristly; outline of cells not clearly visible; cell boundaries raised; outer periclinal walls convex with papillae conical and obtuse or nipple-shaped and aculeate.
- 2a. Papillae conical and obtuse .....  
..... 8a. *H. hockii* var. *hockii*
- 2b. Papillae nipple-shaped and aculeate .....  
..... 8c. *H. hockii* var. *katangensis*

**8a. *Hypoxis hockii* var. *hockii*.** Figures 9F, 10C, D.

*Herb* to 30 cm high; *rhizome* ca. 3 cm; tunic to 4.8 cm. *Outer leaves* ca. 2, oblong, 3–12 × 1–3 cm, pubescent, especially on margins, with long, tufted trichomes; nerves ca. 21; *inner leaves* 4 to 6, linear, 12–25 × 0.8–1.4 cm, spathe-like in basal part, densely villous with long, white, tufted trichomes; nerves unequal 15 to 25, 4 or 6 nerves much larger than others. *Scapes* ca. 4, 14–30 cm × 2–4 mm, narrowly winged and ciliate at base, trichomes white; *raceme* 9–11-flowered; *bracts* 3-nerved; *pedicels* 2–14 mm long. *Outer tepals* ovate, 14–15 × ca. 6 mm, 7-nerved; *inner tepals* shortly cuspidate at apex, 13–14 × ca. 7 mm, pilose on lower third of midrib, 5-nerved; *stamens* 5–7 mm long; *filaments* subulate, ca. 3.5 mm long; *anthers* fused at apex, 4–5 mm long; *ovary* 4–9 × ca. 3 mm; *style* terete, 4.5–5.0 mm long; *stigma* composed of 3 linear lobes fused to apex, 1.5–2.0 mm long. *Capsule* 5–9 × 3–4 mm; *seeds* ovoid, ca. 2 × 1.5 mm; seed coat with conical papillae obtuse at apex.

*Additional specimens examined.* CONGO-KINSHASA. **Shaba:** s.l., *Hock s.n.* (BR); Kaniama, *Quarré* 2673 (K); Plateau des Kundelungu, *Lisowski, Malaisse & Symoens* 7565 (POZG).

*Hypoxis hockii* var. *hockii* is known only from a

few collections, including a type collection of the species. Black seeds with smooth conical papillae (Fig. 10C, D) distinguish this taxon from other varieties.

**8b. *Hypoxis hockii* var. *colliculata*** Wiland, var. nov. TYPE: Congo-Kinshasa. Shaba: Plateau des Kundelungu, on the riverside of Lofoi, *Lisowski, Malaisse & Symoens* 7682 (holotype, POZG!). Figures 9A–E, 10F.

Haec varietas *H. hockii* var. *hockii* et var. *katangensis* affinis, sed ab eis testa colliculata micropapillataque distinguitur.

*Outer leaves* linear, 5–20 × (1.0–) 1.6–4.0 cm, pubescent especially below; nerves 17 to 23 (to 31); *inner leaves* 15–78 (–102) × 0.8–2.0 cm, prominently villous on margins and midrib below and sparsely villous on whole surface with bright tufted trichomes; nerves 11 to 31. *Scapes* 3 to 7, 17–34 (–50) cm × ca. 3 mm wide, broadly winged and ciliate in basal part; *raceme* 6- to 12-flowered; the lowermost *bracts* 10–17 × ca. 2 mm, 3-nerved, bracts in apical part of inflorescence 5–10 × ca. 1 mm wide, abaxially pubescent on midrib; *pedicels* 4–20 mm long, prominently pubescent. *Tepals* 6, yellow or orange-yellow; *outer tepals* elliptic, (9–) 13–16 × (3–) 5–6 mm, 5- to 9-nerved; *inner tepals* ovate, shortly cuspidate at apex, (8–) 11–15 × (5–) 6–8 mm, abaxially pilose on two lower thirds of midrib, 5- to 7 (to 9)-nerved; *stamens* 5–8 mm long; *filaments* subulate, 3.5–4.5 mm long; *anthers* fused or retuse at apex, 4–7 mm long; *ovary* (3–) 4–6 × (2–) 3–5 mm; *style* subterete or trigonous, 1.0–3.5 mm long; *stigma* 1–4 mm long, wider than style or equal, obtuse at apex, composed of 3 linear papillate receptive surfaces or of 3 free triangular lobes with papillae on margins. *Capsule* (4–) 5–7 × 3–5 mm diam.; *seeds* spherical or ovoid, ca. 2 × 1.5 mm, black and matte; seed coat colliculate and micropapillate.

*Additional specimens examined.* CONGO-KINSHASA. **Shaba:** Environs de Lubudi, *Cabu* 36 (BR); Nkala, Kambove, *Pauwels* 6922 (BR); Kipopo, 25 km ONO d'Elisabethville, *Schmitz* 4199 (BR); Luiswishi, *Malaisse* 13695 (BR); Katubu, *Quarré* 765 (BR); Plateau des Kundelungu, au bord de la rivière Lofoi, *Lisowski, Malaisse & Symoens* 7654 (POZG); Plateau des Marungu, Mount Kampilikwe, 3 km au NNW de Kionta, *Lisowski, Malaisse & Symoens* 8574a (POZG).

The rhizome of *Hypoxis hockii* var. *colliculata* is edible. This variety is the most common and variable taxon within *H. hockii* in Central Africa. Polymorphism in stigma and stamen shape may be observed among these plants (Fig. 9A–D). Seeds with



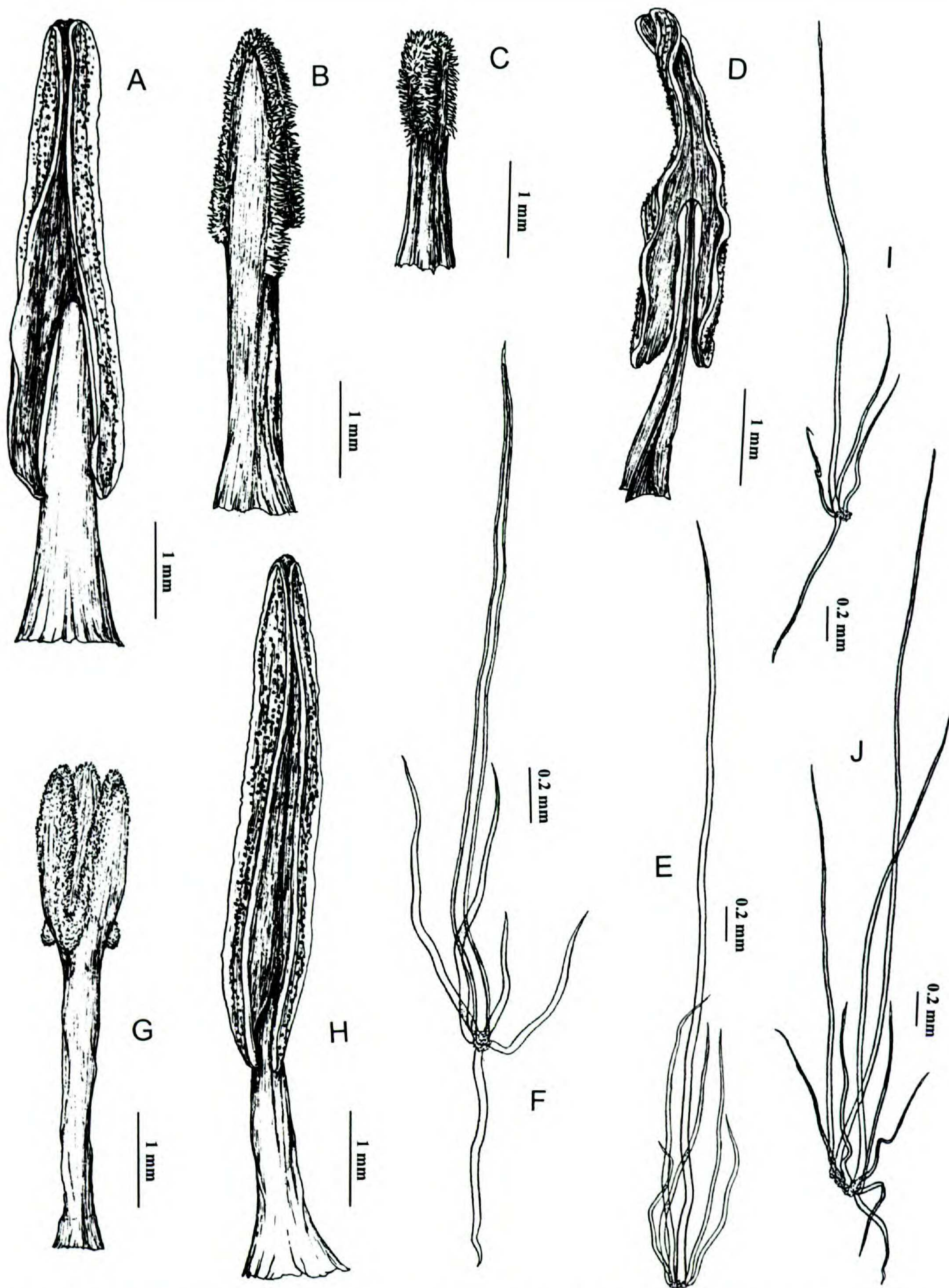


Figure 9. A–E. *Hypoxis hockii* var. *colliculata*. —A. Stamen fused at apex (ventral view). —B. Pyramidal stigma. —C. Oblong stigma. —D. Stamen retuse at apex. —E. Tufted trichome from a scape. —F. *Hypoxis hockii* var. *hockii*, tufted trichome from a scape. G–J. *Hypoxis hockii* var. *katangensis*. —G. Free-lobed stigma. —H. Stamen (ventral view). —I. Tufted trichome from a leaf midrib. —J. Tufted trichome from a leaf margin. A and B from Lisowski, Malaisse & Symoens 7682 (POZG); C and D from Schmitz 4199 (BR); E from Lisowski, Malaisse & Symoens 7654 (POZG); F from Lisowski, Malaisse & Symoens 7565 (POZG); G–J from Lisowski, Malaisse & Symoens 11797 (POZG).



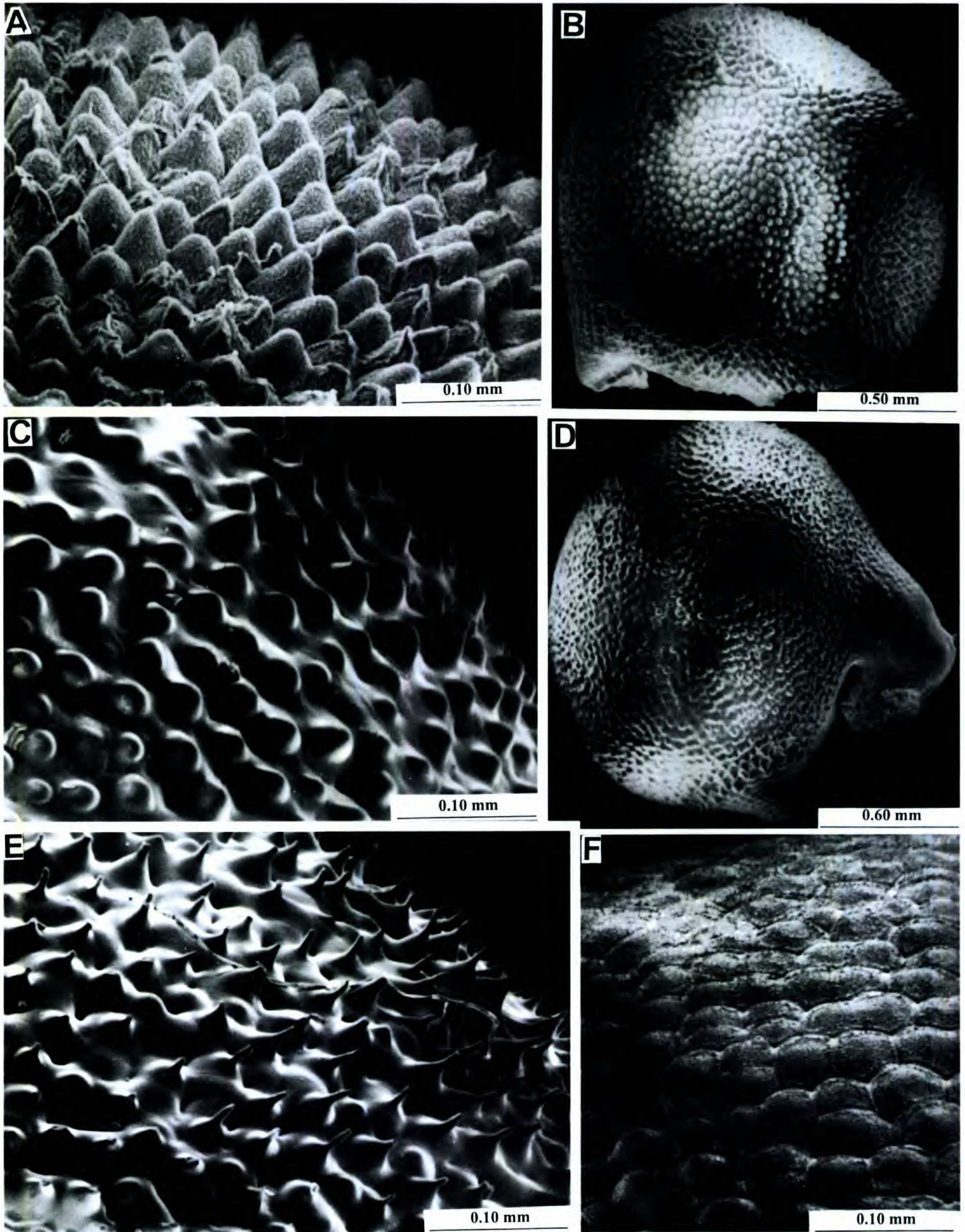


Figure 10. A, B. *Hypoxis subspicata*. —A. Seed coat sculpture. —B. Seed. C & D. *Hypoxis hockii* var. *hockii*. —C. Seed coat sculpture. —D. Seed. —E. *Hypoxis hockii* var. *katangensis*, seed coat sculpture. —F. *Hypoxis hockii* var. *colliculata*, seed coat sculpture. A and B from *Duvigneaud & Timperman 2528* (BRLU); C and D from *Hock s.n.* (BR); E from *Lisowski, Malaisse & Symoens 11797* (POZG); F from *Lisowski, Malaisse & Symoens 7682* (POZG).



flat verrucose papillae (Fig. 10F) are a stable character distinguishing this taxon.

**8c. *Hypoxis hockii* var. *katangensis*** (Nel ex De Wild.) Wiland, comb. et stat. nov. Basionym: *Hypoxis katangensis* Nel ex De Wild., Bot. Jahrb. Syst. 51: 312. 1914. TYPE: Congo-Kinshasa. "Oberer Kongo-Bezirk: Katanga," 1900, *Verdick s.n.* (holotype, BR!). Figures 9G–J, 10E.

*Herb* to 36 cm high. *Outer leaves* wide elliptical 3.6–7.8 × 4–5 cm, pubescent on whole surface below with long white two-branched or tufted trichomes, sparsely pubescent in apical part above; nerves 27 to 39; *inner leaves* 5 to 15, linear, 10.5–35.0 × 0.8–14 cm, prominently pubescent on margins and the midrib below with tufted trichomes, on surface only sparsely pubescent with 2- or 3-branched trichomes, in basal part only ciliate; nerves 25 to 39. *Scapes* 5 to 12, 7–34 cm × ca. 3 mm wide, pubescent with golden tufted trichomes; raceme 10- to 13-flowered; *bracts* 13–20 × 1–2 mm wide, the lowermost usually 1-nerved, rarely 3-nerved; *pedicels* 7–15 mm long. *Tepals* 6; *outer tepals* 10–12 × 4–5 mm wide, 5- to 9-nerved; *inner tepals* broadly ovate, obtuse at apex, 10–11 × 4–7 mm wide, 7-nerved, pilose abaxially on lower two thirds of midrib; *stamens* 7–10 mm long; *filaments* almost linear, ca. 3.5 mm long; *anthers* 4.5–8.0 mm long, slightly or not emarginate at apex; *ovary* 3.5–4.0 × 3.5–4.0 mm wide; *style* ca. 4 mm long; *stigma* ca. 2 mm long, composed of 3 fused lobes and conical or composed of 3 free lobes, obtuse at apex. *Capsule* 6–7 × 4–5 mm; *seeds* ovoid, ca. 1.5 × 1 mm wide, black and glossy; seed coat with long-acuminate conical papillae.

*Additional specimens examined.* CONGO-KINSHASA. **Shaba:** Plateau des Marungu, Mont Kibobwa, près du village Kibobwa, *Lisowski, Malaisse & Symoens 11797* (POZG). ZAMBIA. Kalungwisi Flüsschen, *Fries 1148* (Z).

*Hypoxis hockii* var. *katangensis* is known only from a few collections. Seeds with long-acuminate conical papillae (Fig. 10E) and less dense indumentum of the leaves distinguish this taxon from other varieties.

**9. *Hypoxis kilimanjarica*** Baker, in Dyer, Fl. Trop. Afr. 7: 378. 1898. TYPE: Tanzania. "Marangu, Lager am Ruassibach, Bergwiese oberhalb des Urwaldes, 2440 m, 31.08.1893," *Volkens 781* (holotype, B!; isotypes, K!, BM!). Figures 11A, 12A, B.

*Hypoxis incisa* Nel, Bot. Jahrb. Syst. 51: 301. 1914.

TYPE: Tanzania. Lutindi, 1900, *Liebusch s.n.* (lectotype, designated by Nordal et al. (1985), B!).

*Herb* to 20 cm high; *rhizome* subglobose, 6–14 × 6–13 mm diam. (dried out); tunic black membranous, to 2.5 cm high, occasionally with some soft fibers; roots not very thick. *Outer leaves* ca. 2, grouped in short pseudostem, oblong, acute, ca. 3 cm × 4 mm wide, ciliate on margins or glabrous; nerves unequal, ca. 7; *inner leaves* 3 to 8, narrow-linear, reflexed to prostrate, often spathe-like in basal part, 3.5–22.0 cm × (1–) 2–4 mm, sparsely pilose on margins and midrib below, sometimes also on the blade surface; trichomes 2- to 3-branched; nerves unequal, 9 to 13, some of them very thin. *Scapes* 1 to 4, 4–16 cm × 0.3–1.0 mm, usually bending downward after flowering, narrowly winged and ciliate at base, in upper half wider and pubescent; trichomes 2-branched, golden or red-brown; *flowers* single or 2, often the second bud remaining undeveloped; *bracts* single, rarely 2, subulate, very narrow, acute, 3–10 × 0.4–1.0 mm, pubescent abaxially with 2-branched trichomes along nerve; *pedicels* 2.5–6.0 mm long, pubescent with 2- to 5-branched trichomes. *Tepals* 6, exceptionally 3 or 4; *outer tepals* elliptic, acute, 5–7 × 2–3 mm, pubescent abaxially with 2- to 5-branched trichomes, irregularly 7-nerved; *inner tepals* elliptic or ovate, cuspidate, 4–7 × 1.5–3.0 mm, pubescent along lower ¾ of midrib abaxially, irregularly 5-nerved; *stamens* unequal; outer stamens 3–4 mm long with filaments 2–3 mm long; inner stamens 2.5–3.5 mm long with filaments 1.5–2.0 mm long; *filaments* subulate; *anthers* 1.5–2.0 mm long, sagittate, fused and obtuse at apex; *ovary* obconical, 2–4 × ca. 1.5–2.0 mm, pubescent; *style* wider in basal part, trigonous, 1–2 mm long; *stigma* pyramidal, obtuse at apex, with three stripes of papillae, 1–2 mm long; proportion of length of style to length of stigma various. *Capsule* obovoid, 4–8 × 2.5–3.5 mm, almost glabrous; *seeds* numerous, ovoid, ca. 1.5 × 1 mm, black; seed coat colliculate.

*Distribution and ecology.* Congo-Kinshasa, Rwanda, Burundi (Fig. 22), Kenya, Tanzania. For Central Africa this species was previously reported from Congo-Kinshasa (as *H. incisa* Nel in Robyns & Tournay, 1955) and from Rwanda (Champluvier, 1987), though it also occurs in Burundi. Montane woodland, montane grassland, often associated with *Erica*; on rocky, moist soils; alt. 1850–2950 m. Flowering from January to March, from May to June, and from August to October.

*Additional specimens examined.* CONGO-KINSHASA. **Haut-Zaïre:** Awo, Mt. Aboro, *Froment 681* (BR). **Kivu:** Mt. Kahuzi, *Bamps 2878* (BR, K); Buzuzu, *Hen-*



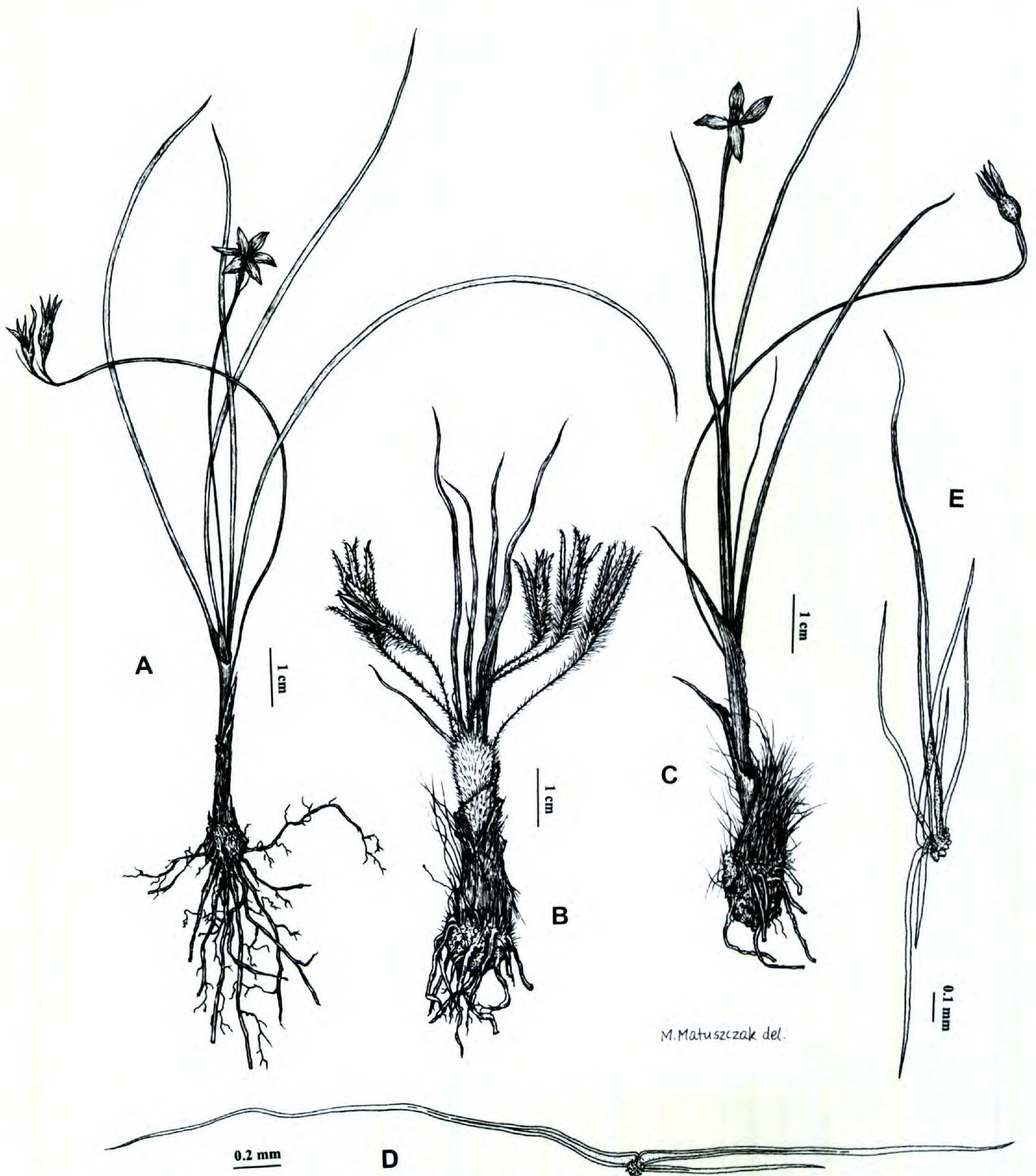


Figure 11. —A. Habit of *Hypoxis kilimanjarica*. —B. Habit of *Hypoxis lusalensis*. —C. Habit of *Hypoxis monanthos*. —D. Three-branched trichome from a scape of *Hypoxis monanthos*. —E. Tufted trichome from a scape of *Hypoxis lusalensis*. A from Lewalle 3997 (BR); B from Lisowski, Malaisse & Symoens 8453 (POZG); C from Lisowski B7173 (POZG); D from Lisowski, Malaisse & Symoens 10710 (POZG); E from Lisowski, Malaisse & Symoens 8557 (POZG).

*drickx* 4780 & 4832 (BR). RWANDA. Cyanguu, Mt. Bigugu, *Bamps* 3302 (BR), *Christiaensen* 1620 (BR); forest of Nyungwe, *Bouxin* 429 & 984 (BR); Rugege, *Christiaensen* 1501 (BR). BURUNDI. Muramwya, Mt. Manga, *Reekmans* 756 (BR) & 2065 (BR, MO); *Lewalle* 584 & 1102 (BR); Teza, *Reekmans* 1335 (BR, MO), *Smets* 13 (BRLU); Nyabigondo-Teza, *Lewalle* 3997 (BR); Teza, Mt. Ngoma, *Lejoly* 84/719 (BRLU); Bururi, Tora, *Reekmans* 23 (BR, MO), *Lewalle* 5130 (BR, MO); Luvironza, INEAC, *Michel* 5007 (BR).

*Vernacular name.* Bukanga-Tshiragaga (dialect Bashi).

*Hypoxis kilimanjarica* is primarily an East African species. Studied by Nordal et al. (1985) it is divided into *H. kilimanjarica* subsp. *kilimanjarica* and *H. kilimanjarica* subsp. *prostrata* Holt & Staubo. In Central Africa only the typical subspecies with erect or slightly reflexed leaves and scapes



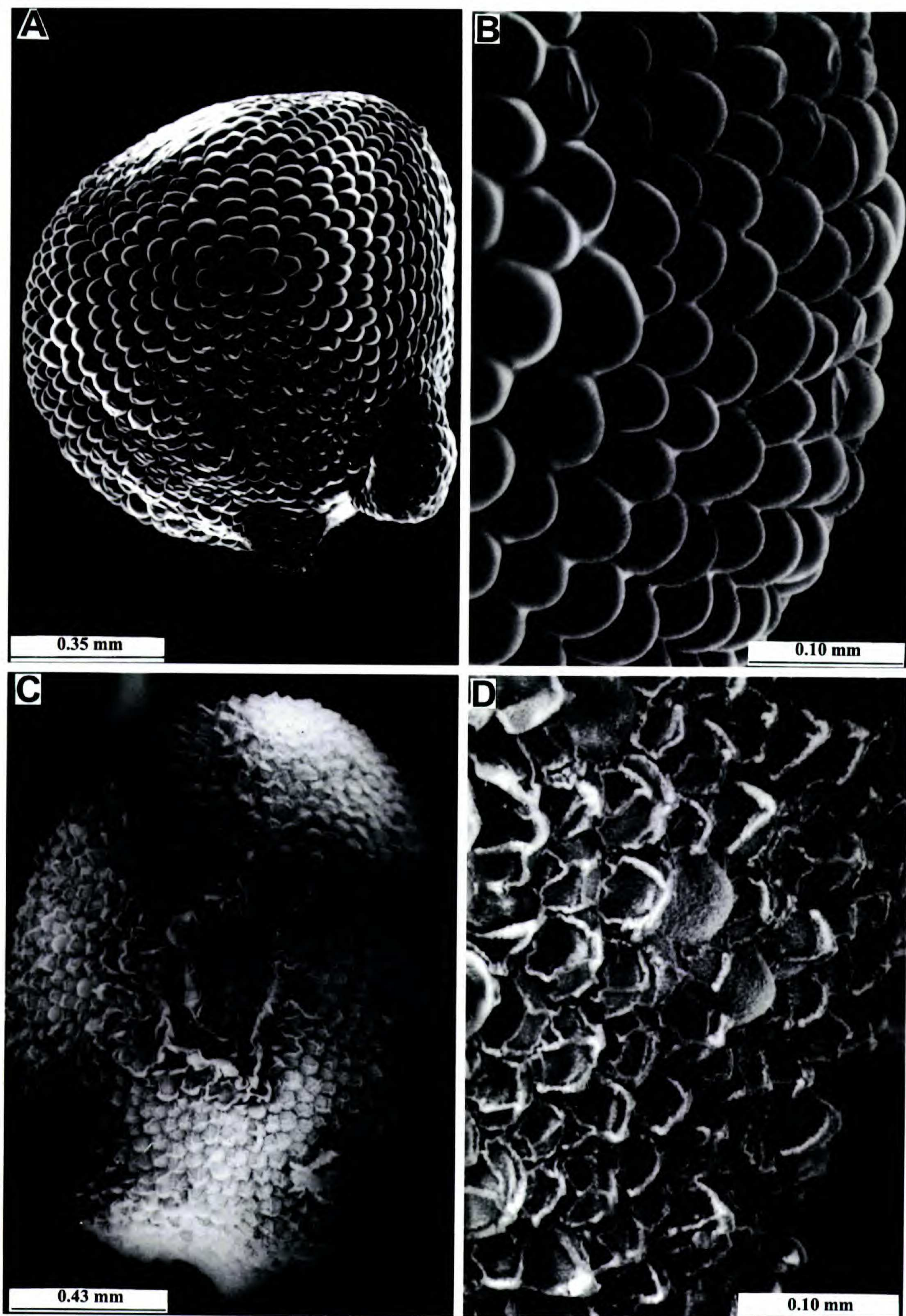


Figure 12. A, B. *Hypoxis kilimanjarica*. —A. Seed. —B. Seed coat sculpture. C, D. *Hypoxis monanthos*. —C. Seed. —D. Seed coat sculpture. A and B from *Bouxin 984* (BR); C and D from *Lisowski B 7173* (POZG).



(Fig. 11A) more than 4 cm long occurs. The other subspecies bears prostrate leaves and scapes never exceeding 4 cm.

Leaves of *H. kilimanjarica* were sometimes referred to as canaliculate (Nel, 1914b), but according to my observations, they are rather carinate. This feature as well as 9 to 13 veins on inner leaves usually about 2 mm wide distinguish this species from the slightly similar *H. filiformis* (Fig. 6D), which possesses canaliculate leaves, 0.7 mm wide and with 3 nerves. *Hypoxis kilimanjarica* occasionally resembles *H. monanthos*, especially those plants with only 4 tepals. The scapes in both species bend downward after flowering (Fig. 11A, E). *Hypoxis kilimanjarica* is, however, a montane species and occurs above 1850 m, whereas *H. monanthos* only rarely reaches this altitude and is found in very moist habitats. Seeds of the former are black and covered with thin cuticle (Fig. 12A, B), and of the latter brown and coated with thick cuticle (Fig. 12C, D). From *H. angustifolia*, *H. kilimanjarica* is distinguished by shorter pedicels, only to 6 mm long, bending scapes, and black seeds. *Hypoxis angustifolia* bears pedicels at least 12 mm long, erect scapes, and brown seeds (Fig. 3).

**10. *Hypoxis lejolyana*** Wiland, *Fragm. Florist. Geobot.* 42: 418. 1997. TYPE: Congo-Kinshasa. Shaba: "route Dilolo-Kisenge, Kahundu, source de la Lova, Dilolo poste-Dilolo station," Sep. 1958, *Plancke 158/2184* (holotype, BRLU!). Figure 13A, B.

*Herb* to 29 cm high; *rhizome* ovoid, ca. 4 cm diam.; tunic stiff, fibrous, with 2–3 mm wide blades often covered with indumentum, to 7 cm; roots partially terete. *Outer leaves* 2 to 3, ca. 5 cm × 8 mm, basally with membranous margins, linear, pubescent on upper half with 2-branched white or yellow trichomes; nerves unequal, ca. 13; *inner leaves* 3 to 5, linear, prominently keeled, to 29 cm × ca. 3 mm, ciliate on margins and midrib with tufted trichomes, hispid beneath and sparsely pilose above with 2-branched trichomes; nerves unequal, ca. 9. *Scapes* 2 to 4, to 25 cm × ca. 2 mm, winged and glabrous in lower half, wider and pubescent in upper half; *cyme* 2- to 5-flowered; in 5-flowered inflorescences, 3 flowers are clustered at the top, with one sessile and two pedicellate; floral anthesis basipetal; *bracts* subulate, 5–15 × 1 mm, single-nerved, pubescent on midrib abaxially; *pedicels* 2–15 mm long. *Tepals* 6; *outer tepals* ovate, 7.5–8.0 × ca. 3 mm, 7-nerved, pubescent abaxially; *inner tepals* ovate, acute, 7 × ca. 2.5 mm, 5-nerved, pilose along midrib abaxially; *stamens* unequal; outer

*stamens* ca. 3.5 mm long with filaments ca. 1.5 mm long; inner *stamens* ca. 2.5 mm long with filaments ca. 1 mm long; *filaments* subulate; *anthers* linear, deeply sagittate, retuse at top, ca. 2 mm long; *ovary* obconical, ca. 4 × 3–4 mm wide, pubescent; *style* ca. 2 mm long; *stigma* conical, ca. 1 mm long, composed of 3 lobes with margins covered with numerous papillae. *Capsule* turbinate, 6–7 × ca. 4 mm, pubescent; *seeds* ovoid, ca. 2 × 1.5 mm, brown; cuticle thick, brown-black; seed coat with pyramidal pointed projections.

*Distribution and ecology.* A taxon known from Shaba Province in Congo-Kinshasa (Fig. 27) and from one collection in Zambia. Wooded grassland with *Parinari* sp.; pasturage with natural vegetation; on Kalahari sand. Flowering from August to October and in December.

*Additional specimens examined.* CONGO-KINSHASA. **Shaba:** Tschibalaka, *Overlaet 712* (BR); Mangoa, 20 km E de Dilolo-Gare, *Duvigneaud & Timperman 2519* (BRLU); Plateau de la Manika, *Lisowski, Malaisse & Symoens 178* (POZG), *Duvigneaud 4532 H* (BRLU). ZAMBIA. **Western Province:** Kalabo Dist., 2 mi. W of Kalabo, *Drummond & Cookson 6431* (MO).

The tunic covered with indumentum and an inflorescence with basipetal flower anthesis distinguish *H. lejolyana* from all Central African species with leaves not exceeding 8 mm and scapes 1–2 mm wide. Especially the unique shape of the 5-flowered inflorescence with 3 flowers clustered at the top, 2 being pedicellate and 1 sessile, is worth noticing. From *H. subspicata*, a species with a similar but much larger inflorescence, *H. lejolyana* is distinguished by its smaller flowers with tepals to 8 mm long, and inner leaves 3 mm wide. Tepals of *H. subspicata* are longer, to 13–15 mm, and its inner leaves are narrower, to 0.8–2.0 mm wide.

**11. *Hypoxis lusalensis*** Wiland, *Fragm. Florist. Geobot.* 42: 421. 1997. TYPE: Congo-Kinshasa. Shaba: "Plateau des Marungu, 20 km au NNE de Kasiki, sommet Lusale," 2450 m, Nov. 1969, *Lisowski, Malaisse & Symoens 8453* (holotype, POZG!). Figures 7C, D, 11B, E.

*Herb* to 24 cm high; *rhizome* globose, 1.5 cm diam. (dried out); tunic membranous and fibrous, 2–5 cm long. *Outer leaves* 3 to 5, subulate, 2.5–8.5 × ca. 1.4 cm, glabrous at base, apically pubescent below; indumentum gray; trichomes tufted, ca. 6-branched, 0.4–3.0 mm long; nerves unequal 9 to 13; *inner leaves* 4 to 6, narrow-linear, 5–24 cm × 2–3 mm, villous-hispid on margins and midrib below, sparsely pilose above; nerves unequal, 7 to 9. *Scapes* 2 to 4, 5–12 cm × 1.0–1.5 mm, sparsely



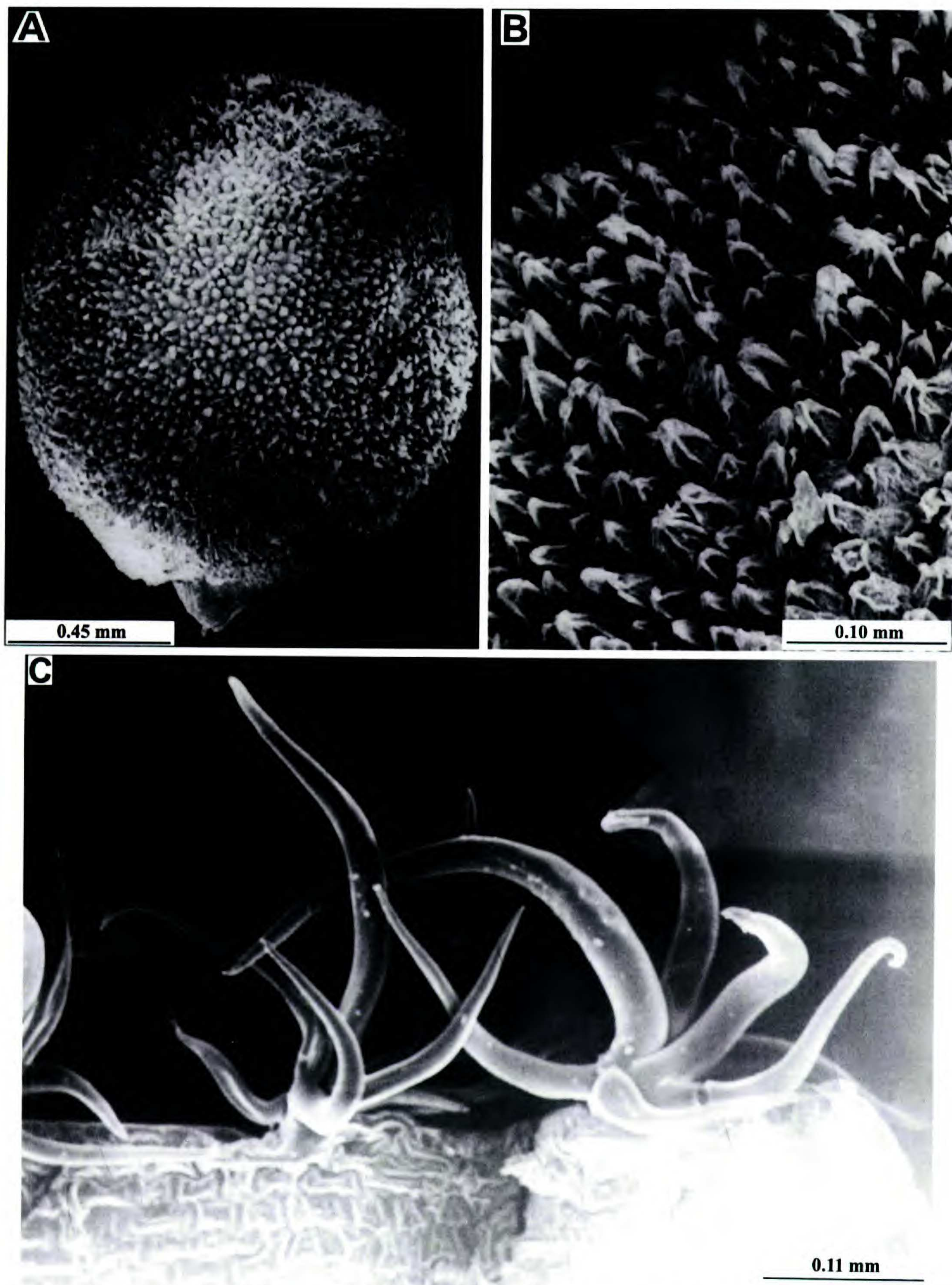


Figure 13. A, B. *Hypoxis lejolyana*. —A. Seed. —B. Seed coat sculpture. —C. *Hypoxis goetzei*, tuft trichomes on a leaf margin. A and B from *Plancke 158/2184* (BR); C from *Quarré 704* (BR).



ciliate in basal half, prominently hispid in upper half; trichomes tufted; *flowers* 1 or 2; *bracts* lanceolate or ovate, acute at apex, 2–12 × 1–3 mm, hispid abaxially; *pedicels* 6–14 mm long, elongating with age, hispid. *Tepals* 6; *outer tepals* lanceolate or elliptic, 14–20 × 3.5–4.0 mm, hispid abaxially, 5- to 7-nerved; *inner tepals* elliptic, cuspidate, 13–18 × 4–5 mm, abaxially hispid on midrib in lowest third (or 2/3), 5-nerved; *stamens* equal, 7 mm long; *filaments* subulate, 3.5–4.0 mm long; *anthers* narrow-linear, sagittate, fused at apex, ca. 4 mm long; *ovary* obovoid, 5.0–5.5 × 2.5–3.0 mm, long hispid; *style* triangular, 1.5–2.0 mm long; *stigma* composed of 3 oblong lobes, obtuse at apex, 2.5–4.0 mm long. *Capsule* fusiform, ca. 8 × 3.5 mm, villous; *seeds* numerous, irregularly ovoid, ca. 1 × 1 mm, black-brown; cuticle thick; seed coat with pointed projections.

*Distribution and ecology.* Species known only from Plateau des Marungu in Congo-Kinshasa (Fig. 22), where it occurs in grasslands and river valleys; alt. 1700, 2320–2450 m. Flowering November.

*Additional specimens examined.* CONGO-KINSHASA. **Shaba:** Plateau des Marungu, pente N de la montagne Lusale, *Lisowski, Malaisse & Symoens 8557* (POZG); Mt. Lusale, *Lisowski, Malaisse & Symoens 8300 & 8684* (POZG); Marungu, section Mulongoshi, *Quarré 7252* (BR) pro parte quoad “c.”

*Hypoxis lusalensis* is very easy to recognize among Central African taxa due to its flowers with long tepals to 20 mm, large relative to its small stature (Fig. 11B), and 2–3 mm wide inner leaves covered with long, gray hispid indumentum. Given its morphological uniqueness, further studies will be needed to determine its relationships to other species.

**12. *Hypoxis malaissei*** Wiland, *Fragm. Florist. Geobot.* 42: 418. 1997. TYPE: Congo-Kinshasa. Shaba: “28 km au N.E. de Lubumbashi,” alt. 1208 m, Apr. 1971, *Malaisse 7403* (holotype, BR!). Figure 14A, B.

*Herb* to 16.5 cm high; *rhizome* globose, ca. 10 mm diam. (dried out); tunic membranous and fibrous, black, to 2 cm. *Outer leaves* ca. 2, ovate, ca. 10 mm wide, spathe-like in basal part, pubescent beneath with tufted trichomes; *inner leaves* ca. 4, linear, 7.5–16.5 cm × 2.5–4.0 mm, hispid; trichomes 2-branched, white; nerves unequal, 2 as large as midrib, ca. 7. *Scapes* 1 to 3, ca. 9.5 cm × 1.5 mm, hispid, especially in upper half, with long white tufted trichomes; *flowers* 2, sometimes 1 flower developed and 1 remaining as an undeveloped bud; *bracts* subulate, ca. 5.5 × 1 mm, hispid along

midrib abaxially; *pedicels* 7–12 mm long, hispid. *Tepals* 6; *outer tepals* elliptic, keeled, 7.5 × 2.5 mm, densely hispid abaxially, irregularly 5-nerved; *inner tepals* obovate, acute at apex, 6.5 × 2.5 mm wide, hispid abaxially on midrib on lowest 1/3, irregularly 5-nerved; *stamens* equal, ca. 4 mm long; *filaments* filiform, ca. 2.5 mm long; *anthers* ca. 2 mm long, sagittate, fused and obtuse at apex; *ovary* obconical, ca. 3.5 × 2.5 mm wide, hispid; *style* slender, ca. 1.5 mm long; *stigma* ca. 1 mm long, composed of 3 very thin rows of papillae, obtuse at apex. *Capsule* obovoid, ca. 5 × 3.5 mm, hispid; *seeds* several, ovoid, 2 × 1 mm wide, black; seed coat honeycombed.

*Distribution and ecology.* Endemic to Shaba Province of Congo-Kinshasa (Fig. 22), *H. malaissei* is known only from a single collection in miombo; alt. 1208 m. Flowering in April.

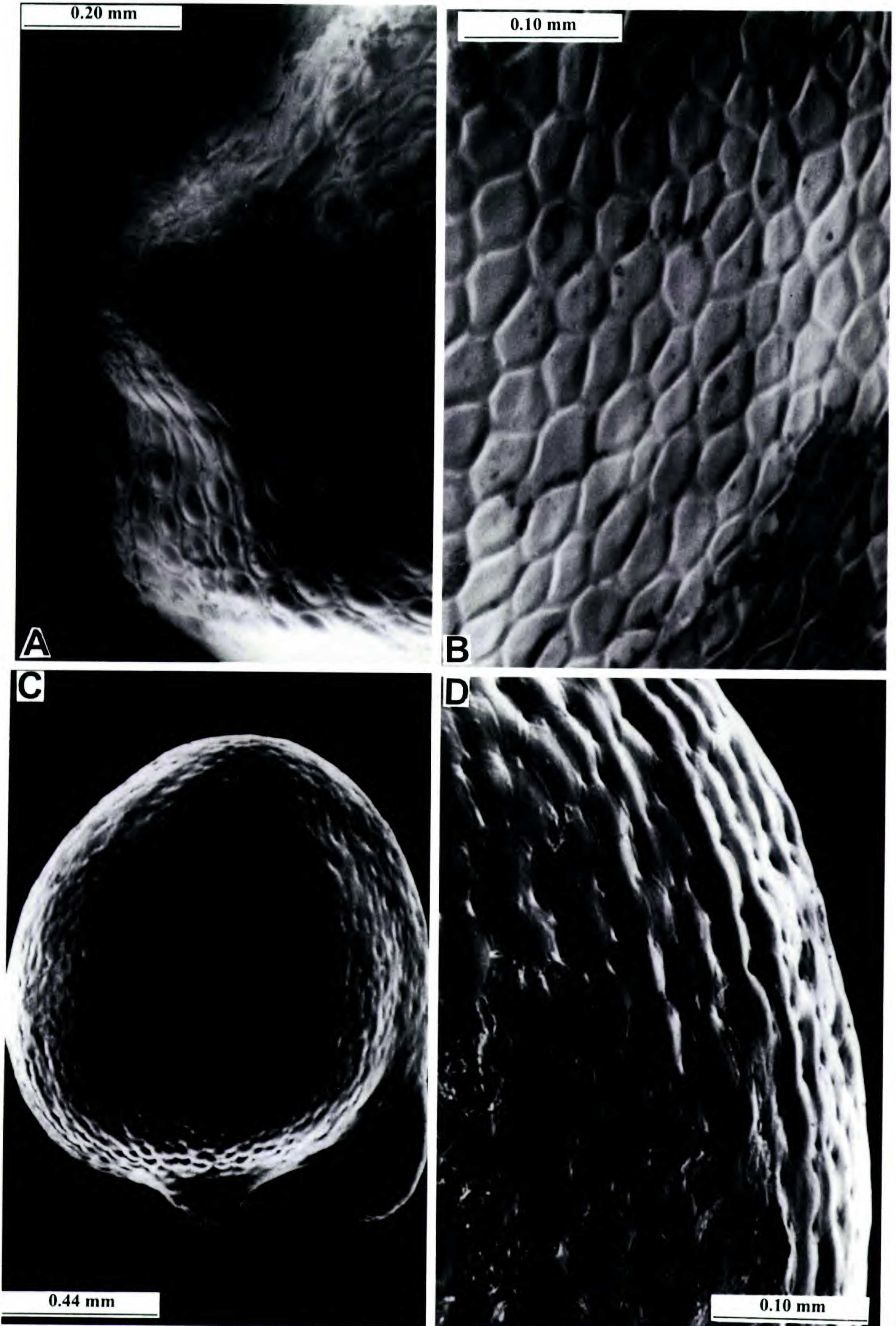
*Hypoxis malaissei* closely resembles *H. muhilen-sis*, which occurs further north on Plateau des Muhila. Both species share a robust habit and partially fibrous tunic, which distinguishes them from slender *H. angustifolia* with its membranous tunic. However, *H. malaissei* possesses black seeds with a thin cuticle displaying a most unique honeycombed seed coat sculpture (Fig. 14 A, B). The two aforementioned species bear brown seeds, covered with thick cuticle (Figs. 3, 17). More collections will be needed to determine the taxonomic position and relationships of *H. malaissei* to other species.

**13. *Hypoxis malosana*** Baker, *Bull. Misc. Inform.* 1897: 284. TYPE: Malawi. “Mount Malosa, near Zomba,” alt. 4000–6000 ft., *Whyte s.n.* (holotype, K!). Figures 15A–C, 16.

*Hypoxis biflora* De Wildeman, *Repert. Spec. Nov. Regni Veg.* II: 537. 1913. TYPE: Congo-Kinshasa. “Ober-Katanga,” Oct. 1911, *Hock s.n.* (holotype, BR!).

*Herb* to 20–50 cm high; *rhizome* ovoid, 1.0–4.5 × 1.1–4.0 cm (dried out); tunic fibrous, stiff black, to 6 cm high. *Outer leaves* 1 to 3, ovate, 3.0–14.5 cm × 4–10 mm, pilose below; trichomes 2-branched; nerves unequal, 7 to 13; *inner leaves* 5 to 11, narrow-linear, 2.8–61.0 cm × 1–3 mm wide, hispid on margins and midrib below; trichomes 2-branched, ca. 3 mm long, falling off with age, red-brown or golden; nerves unequal 5 to 11. *Scapes* 2 to 10, 2.5–57.0 cm × 0.5–1.0 mm, often red tinted, in basal half ciliate with 2-branched trichomes, in upper half pubescent with tufted trichomes; trichomes white to red-brown, 0.4–1.3 mm long; *cyme* corymbiform, 2- to 4-flowered, with pedicels of significantly various length; *bracts* subulate, 2–8 × ca. 1 mm, pubescent along midrib abaxially; *pedicels*







from almost none at lowest flowers in the inflorescence to 23 mm long at upper, pubescent. *Tepals* (5) 6; *outer tepals* elliptic, 6–12 × 2–3 mm; appendage minute, pubescent abaxially, with 5 to 7 parallel nerves; *inner tepals* oblong or ovate, acute at apex, 5.0–11.5 × 2–4 mm, almost glabrous with few trichomes at base abaxially, with 3 to 7 parallel nerves; *stamens* unequal; outer stamens 2.5–5.0 mm long with filaments 2.0–3.5 mm long; inner stamens 1.5–3.0 mm long with filaments 0.5–1.5 mm long; *filaments* filiform; *anthers* 1.5–2.5 mm, sagittate, emarginate at apex; *ovary* obconical, 2.0–3.5 × 1.5–2.5 mm, pubescent; *style* to 0.5 mm long, or stigma sessile; *stigma* oblong or pyramidal, obtuse, composed of 3 oblong lobes, entirely fused or emarginate at apex, 1.3–2.2 mm long. *Capsule* obovoid, 3–5 × 2–3 mm, pubescent, opening by transverse slit; *seeds* numerous, ovoid, ca. 1.5 × 1 mm, black; seed coat prominently colliculate.

**Distribution and ecology.** Widely distributed in Congo-Kinshasa and Burundi (Fig. 23), Tanzania, Zambia, Malawi, Zimbabwe, Mozambique, Republic of South Africa. Occurs in miombo, wooded grassland, moist or temporarily inundated grasslands, swamps, dembo, wet river valleys, pastures. Soils moist black, boggy, loamy; gray, kaolin soils; sandy soil; white soils; granite bed; soils with copper; alt. 1000–1810 (–2450) m. Flowering mainly from August to February, sometimes from April to June.

**Additional specimens examined.** CONGO-KINSHASA. **Kivu:** Luemba, *Kinet 49* (=Hendrickx 4361) (BR). **Shaba:** s. l., *Hock s.n.* (BR); 10°46'30"S, 25°17'E, *Schajjes 3032* (BR); Kambove, Kisungu, *Streel 331* (BR); Dikuluwe, *Duvigneaud 4129 & 4130H<sub>1</sub>* (BRLU); Lubumbashi, route de Sakania, *Duvigneaud 4312 & 4861* (BRLU); Kisanga [= Keyberg], 7 km SSO d'Elisabethville, *Schmitz 2109* (BR); vallée Kimilolo, *Detilleux 383* (BR); Kapeluka, 20 km NO d'Elisabethville, *Schmitz 7675* (BR); 28 km NO d'Elisabethville, *Schmitz 5855* (BR); Dilungu à 9 km de Dilolopost vers Katundu, rivière Mokwegi près de Kandala, *Plancke 159/2206 & Plancke 159/2214* (BRLU); environs de Lubumbashi, bord de la Natwebo, *Lisowski 81124 & 81146 & B-7173B & B-7270A & B-7271 & B-7279A* (POZG); au SE de Lubumbashi, près de la Mission Don Bosco, *Lisowski 82460 & B-7272* (POZG); environ 30 km au N de Lubumbashi, près de la ferme St. Hubert, *Lisowski 81145* (POZG); Kipopo, 25 km ONO d'Elisabethville, *Schmitz 4198* (BR), *Symoens 13672* (BR); Kaponda, *Malaisse 13562* (BR, WAG); à 1.5 km à l'E de Kabiashia, *Malaisse 6100* (BR); Katuba, *Quarré 719 & 3717 & 4314* (BR); vallée de la Karavia, *Quarré 3527*

(BR); environs de Kabiashia, près du village Kimangu, *Lisowski 81109 & Lisowski 81121* (POZG); vallée de Lupula, près de Kiniamba, *Lisowski 81122 & Lisowski B-7274 & Lisowski B-7277* (POZG); Gombela, *Lisowski B-7231* (POZG); environs de Tshinsenda, *Lisowski B-7273* (POZG); domaine de Muhila, au-dessus de Kalobele, *Lisowski 7274* (POZG); vallée de la Potopo, *Schajjes 2398* (BR); P.N. Upemba, *Heine 108 & U 111* (BR), *de Witte 7181* (BR); Mukana, *de Witte 2741* (BR); Kibara, entre Buyabalo et Katonga, *Robyns 3604* (BR); Mitwaba, *Duvigneaud & Timperman 2697* (BRLU); Plateau des Kundelungu, *Lisowski, Malaisse & Symoens 1155 & 7470 & 7596* (POZG); à 3 km au S de la source occidentale de la Lutshipuka, *Lisowski, Malaisse & Symoens 7744* (POZG); près de la source de la Lutshipuka, *Lisowski, Malaisse & Symoens 810* (POZG); 3 km à W du Poste Lualala, *Lisowski, Malaisse & Symoens 7477* (POZG); contreforts des Kundelungu, vallée de la Kapolo, près du village Kibuzi, *Lisowski 92473* (POZG); Plateau du Bianco, *Duvigneaud 1319* (BRLU); au S de Bianco-Gare, *Duvigneaud 1324* (BRLU); Kiankwali, *Duvigneaud 4471* (BRLU); Dilungu-Yulu entre Nzilo et Kensenia, *Duvigneaud & Timperman 2626* (BRLU); près de la gare Kensenia, *Lisowski, Malaisse & Symoens 13531* (POZG); au N du Tenke, *Duvigneaud 1311* (BRLU); Plateau des Marungu, section de Mulungoshi, *Quarré 7256* (BR); à 3 km au SE du Poste Mulungoshi, *Lisowski, Malaisse & Symoens 8125 & 8134A* (POZG); sommet Lusale, à 10 km au NNE de Kasiki, *Lisowski, Malaisse & Symoens 8369* (POZG); environs de Kasiki, mare Kasozia, *Lisowski, Malaisse & Symoens 12058A* (POZG); à env. 18 km de Pepa, *Symoens 779* (BRLU); Elgymapepa, *Kisimba, Muzinga & Matamba 136* (BR); à 5 km à l'W de Niembe, *Lisowski 8023 & 82893* (POZG); Plateau de la Manika, Katentania, *Homblé 809* (BR), *Doumen 9* (BR); entre Kolwezi et Djoni, *Lisowski, Malaisse & Symoens 7822* (BR, POZG); Plateau de la Mangoa, Dilolo, *Duvigneaud & Timperman 2404 & 2406* (BRLU). BURUNDI. Nyakazu, *Rameloo 4775* (BR); Bururi, *Becquet 2153* (BR); Rutana, *Staner 2077* (BR).

**Vernacular name.** Ngandama (Luemba, *Kinet 49*).

*Hypoxis malosana* is a common and easy-to-distinguish species with a characteristic large, black, stiff, and fibrous tunic (Fig. 15A, B). Its other characteristic is the inflorescence with pedicels greatly varying in length. Its rhizome is edible.

In Central Africa *Hypoxis filiformis* might be confused with *H. malosana*, seen as an undeveloped exemplar of the latter (Fig. 6D). *Hypoxis malosana*, however, always bears a prominent tunic, while the tunic of *H. filiformis* is mainly membranous, with only few soft fibers. It seems, however, that in South Africa such species as *H. malosana*, *H. junodii* Baker, and *H. caespitosa* Baker have overlapping morphological variability, being very similar in ap-

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Figure 14. A, B. *Hypoxis malaissei*. —A. Micropylar end of the seed. —B. Seed coat sculpture. C & D. *Hypoxis robusta*. —C. Seed. —D. Seed coat sculpture. A and B from *Malaisse 7403* (BR); C and D from *Duvigneaud & Timperman 2213* (BRLU).





M. Matuszczak del.



pearance with black colliculate seeds (Fig. 16) and prominent tunics. Therefore, this complex of species is in need of thorough evaluation in this region to establish relationships among them, as well as between this group and *H. filiformis*. *Hypoxis filiformis* and *H. malosana* were confused in the past (De Wildeman, 1921; Zimudzi, 1996), and it is certain that more investigation of their relationship is needed.

For the flora of Central Africa, *H. malosana* was described by De Wildeman (1913) as *Hypoxis biflora*. This name was illegitimate when published, being a later homonym of *H. biflora* Baker (Baker, 1876). Later Baker (1878a) reduced his *H. biflora* to taxonomic synonymy under *H. angustifolia* Lam. Nel (1914b) invalidly recombined De Wildeman's illegitimate species name as "*H. dregei* Baker" var. *biflora* (De Wild.) Nel. Nel mistakenly listed *H. dregei* Baker at the rank of species, whereas Baker (1878a) had only used the epithet "*dregei*" at the rank of variety, as *H. sericea* Baker var. *dregei* Baker. *Hypoxis sericea* (syntype, Drege 8525, K!) possesses longer, silky adpressed indumentum on the leaves, very different from the hispid indumentum of *H. malosana*. This species does not occur in Central Africa. However, the type specimen of *H. biflora* is a specimen of *H. malosana*. Similar observations were stated by Nordal et al. (1985).

**14. *Hypoxis monanthos*** Baker, Trans. Linn. Soc. ser. 2: 266. 1878. TYPE: Angola. Huilla, Welwitsch 4058 (holotype, BM!). Figures 11C, D, 12C, D.

*Herb* to 16 cm high; *rhizome* subglobose 13–17 × 10–13 mm (dried out); tunic fibrous and membranous, to 3.5 cm high, sometimes absent. *Outer leaves* 3–4, ovate, tapering toward apex, 2–20 cm × 6–10 mm, ciliate on margins; trichomes 2- to 3-branched; nerves unequal, 7 to 9; *inner leaves* 3 to 9, narrow-linear, keeled, often reflexed, 11–34 cm × 2–4 mm, sparsely pilose on margins and midrib below, sometimes also on the blade surface abaxially, with 2- to 3-branched trichomes falling off with age; nerves unequal 5 (7), some of them very thin. *Scapes* 1 to 4, 7–20 cm × 0.5–1.0 mm, narrowly winged and ciliate at base, villous above, usually bent downward after flowering; trichomes 2-branched or tufted, gray or golden; *flowers* single or 2; *bracts* single, rarely 2, subulate, 3–10 × 0.4–1.0

mm, pubescent along midrib abaxially; *pedicels* 0–5 mm long, villous. *Tepals* 4 or 6; *outer tepals* elliptic, 7–9 × 2.5–3.0 mm, pubescent abaxially with 2- to 5-branched trichomes, irregularly 7-nerved; *inner tepals* elliptic, obtuse, with membranous inflexed margins, 7–8 × 3 mm wide, pubescent along lower ¾ of midrib abaxially, irregularly 5-nerved; *stamens* as many as tepals, equal, about 5 mm long; *filaments* subulate, ca. 1 mm wide at base, ca. 3.5 mm long; *anthers* 3 mm long, sagittate, retuse at apex; *ovary* obconical, 4–5 × ca. 2–3 mm, villous; *style* ca. 2.8 mm long; *stigma* oblong, obtuse at apex, composed of 3 wide lobes, 0.5 mm long. *Capsule* obovoid, 5–13 × 3–4 mm, sparsely pilose; *seeds* ca. 14 to 19, ovoid, ca. 2 × 1.5 mm, brown; cuticle thick; seed coat bristly with pointed projections.

*Distribution and ecology.* Congo-Kinshasa and Burundi (Fig. 24), Angola, Malawi.

In wet habitats: swamps, on river borders, temporarily inundated grassy savanna, and dembo; alt. 1220–1900 m. Flowering from January to February, in June and October.

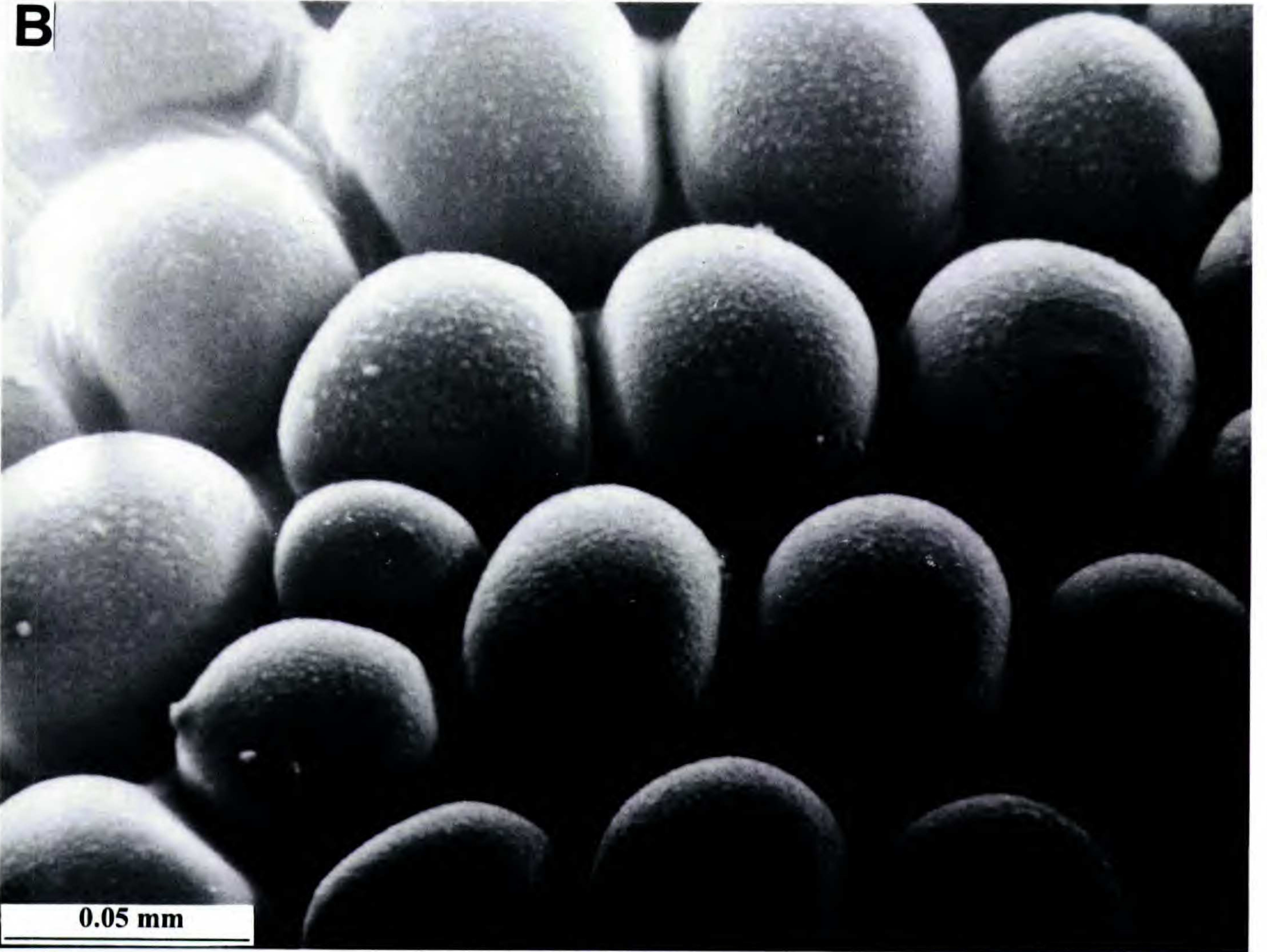
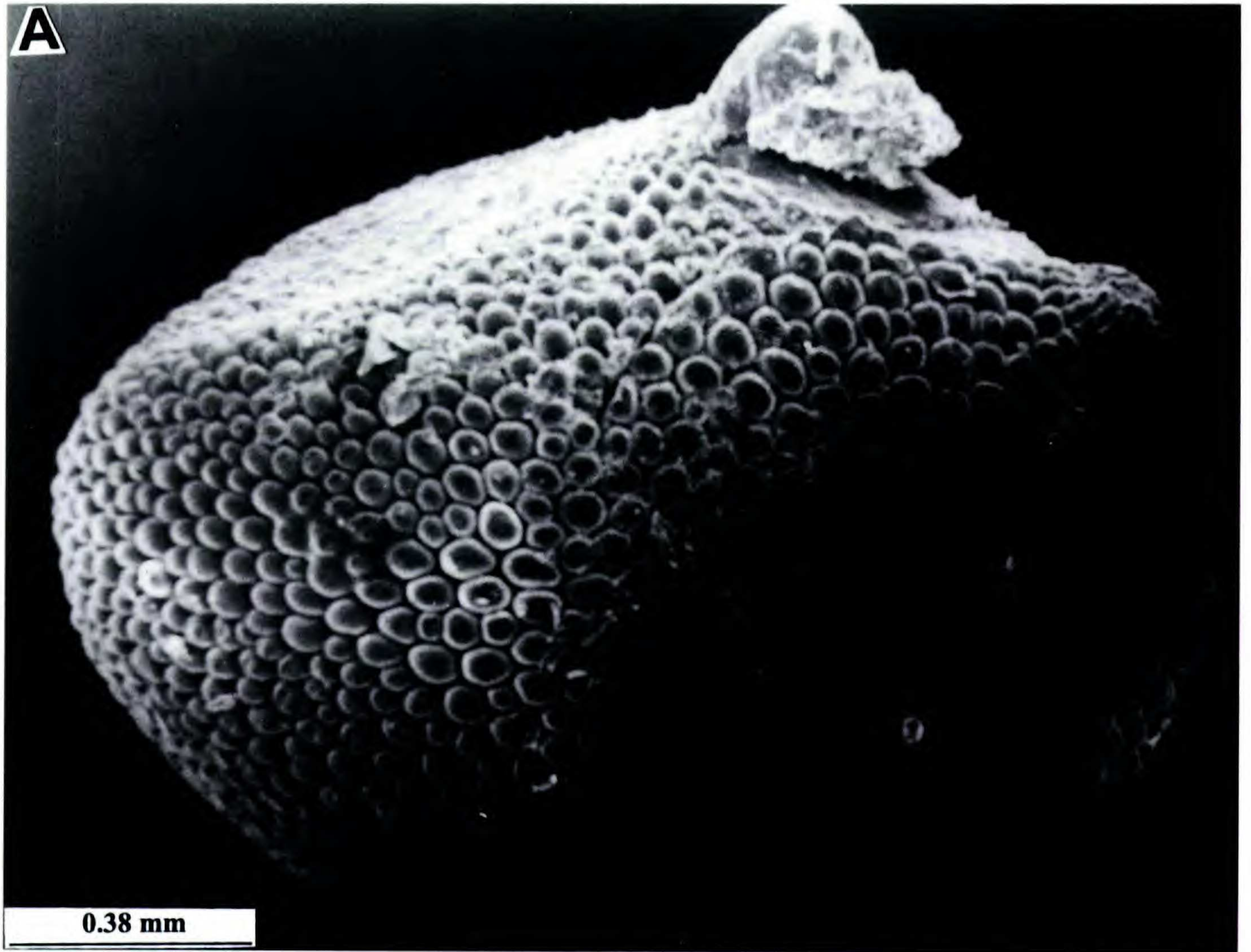
*Additional specimens examined.* CONGO-KINSHASA. **Shaba:** Plateau des Kundelungu, rivière Kalunda, Lisowski, Malaisse & Symoens 12573 (POZG), Lisowski 81120 (POZG); à env. 10 km au NNW du Poste de Luala, Lisowski, Malaisse & Symoens 2652 (POZG); environs de Lubumbashi, bord de la Ntwebe, Lisowski B-7173A (POZG); P. N. de l'Upemba, piste de la Lufira km 8, Bamps 851 (BR); Plateau de la Manika, 4 km à W de Katema, Lisowski, Malaisse & Symoens 184 (POZG); Plateau des Marungu, Lisowski, Malaisse & Symoens 8268 (POZG); environs de Mulungoshi, Mt. Ngoma, près du village Lusinga, Lisowski 10710 c (POZG). BURUNDI. Mosso, Michel 2534 (BR); Kisozi, Becquet 2159 (BR).

*Hypoxis monanthos* was previously reported only from Angola with its range herein extended into Congo-Kinshasa and Burundi (Fig. 24). Most Central African specimens possess single flowers with only 4 tepals. In contrast to many species of *Hypoxis* after flowering, scapes of *H. monanthos* bend to the ground and pedicels bend slightly inward (Fig. 11C). This is an adaptation for seed dispersal in humid habitats and has been noted in other members of the family (Hilliard & Burtt, 1978: 75), for example, *H. decumbens* L. from Central and South America, *Spiloxene aquatica* (L.f.) Fourcade, *Pauridia minuta* (L.f) Durand & Schinz, and *Rhodohypoxis deflexa* Hilliard & Burtt. In Central Africa this character is also found in *H. kilimanjarica*

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Figure 15. A–C. *Hypoxis malosana*. —A. Habit with fruits. —B. Habit with flowers. —C. Tufted trichome from a scape. —D. *Hypoxis muhilensis* subsp. *muhilensis*, tufted trichome from a scape. A from Duvigneaud & Timperman 2626 (BRLU); B from Lisowski 81121 (POZG); C from Lisowski 81109 (POZG); D from Lisowski 81116 (POZG).







(Fig. 11A), which also sometimes has flowers with 4 tepals. However, seeds of the two species differ: *H. kilimanjarica* possesses black, colliculate seeds with a thin cuticle (Fig. 12A, B), and *H. monanthos* bears brown seeds with pyramidal projections and a thicker cuticle (Fig. 12C, D). *Hypoxis kilimanjarica* is a montane species that occurs above 1850 m, whereas *H. monanthos* only rarely reaches this altitude. Plants of *H. monanthos* are also similar to another species, *H. filiformis*, but the former has wider leaves to 2–4 mm, whereas the leaves of the latter species do not exceed 0.7 mm in width. Although *H. monanthos* bears seeds similar to those of *H. angustifolia* (Fig. 3), it differs in much shorter pedicels, only to 5 mm long. Pedicels of *H. angustifolia* are at least 12 mm long.

**15. *Hypoxis muhilensis*** Wiland, Fragm. Florist. Geobot. 42: 412. 1997. TYPE: Congo-Kinshasa. Shaba: "Domaine de Muhila, au-dessus du village Kalobebe," alt. 1690 m, Nov. 1970, Lisowski 81116 (holotype, POZG!).

Herb to 35 cm high; rhizome ovoid or almost spherical, 1.3 × 1.4 cm (dried out); tunic membranous and fibrous, to 7 cm. Outer leaves ca. 5, ovate, narrowing toward apex, acute, 2.0–11.5 cm × 6–10 mm, with midrib and margins densely pubescent and with blade surface only sparsely pubescent in apical part below; trichomes 2-branched or tufted; nerves unequal, 11 to 19; inner leaves ca. 6, narrowly elliptical or linear, 9.5–35.0 cm × 3–5 mm, densely hispid on midrib and margins beneath, sparsely pubescent above; trichomes 2(3)-branched; nerves unequal, 11 to 19; midrib and margin nerves especially prominent. Scapes 4 to 5, 6–20 cm × 1–2 mm, narrowly winged and ciliate in basal half, hispid or pilose apically; cyme 3- to 4-flowered; bracts subulate, keeled, 6–14 mm long, 1 (3)-nerved, hispid on midrib abaxially; pedicels 4–20 mm long, hispid or pilose. Tepals 6; outer tepals elliptic or lanceolate, 10–13 × 2.5–4.0 mm, densely hispid or pilose beneath, 5- to 7-nerved; inner tepals elliptic or ovate, acute, 9–11 × 3.0–3.5 mm, pilose on the lower third or half of midrib abaxially, 5- to 7-nerved; stamens equal or unequal; filaments subulate; anthers linear, sagittate, fused at apex, ca. 3 mm long; ovary obovoid, 4–7 × 2–4 mm, densely pilose; style ca. 0.5–2 mm long; stigma composed of 3 linear lobes, obtuse, or pyra-

midal, acute, 1.5–2.0 mm long. Capsule cylindrical or turbinate, 4–8 × 3–5 mm, hispid or pubescent; seeds numerous, ovoid, 1.5–2.0 × 1.0–1.5 mm, red-brown; cuticle thick; seed coat bristly with pointed projections.

*Distribution and ecology.* *Hypoxis muhilensis* is endemic to Plateau des Muhila in Congo-Kinshasa (Figs. 25, 26). It occurs in grasslands and wooded mountain grasslands; alt. 1400–1690 m. Flowering in November.

*Hypoxis muhilensis* is similar to *H. angustifolia* due to its loose inflorescences, sparsely pilose linear leaves, and brown seeds. The first possesses, however, a fibrous tunic and is more robust, with leaves thick in texture, solid and rigid pedicels, and dense indumentum on the inflorescences composed of rigid tuft trichomes (Fig. 15D). The second species is characterized by a membranous tunic, leaves thin in texture, slender pedicels, and usually sparse inflorescence indumentum with slender, often only 2–3-branched trichomes (Fig. 18H, I). Moreover, I did not find any collection of *H. angustifolia* from Plateau des Muhila. From *H. canaliculata* and *H. malosana*, two other *Hypoxis* species occurring on this plateau, *H. muhilensis* differs in its brown seeds (Figs. 17, 2C, D) and 3–5 mm wide inner leaves, whereas these two sympatric species possess black seeds (Fig. 16) and narrower leaves 1–3 mm wide (Figs. 6A, 15A). *Hypoxis muhilensis* includes two subspecies.

- 1a. Outer tepals 12–13 × 4 mm; seed coat cells tightly covered with smooth cuticle, which forms long, filiform projections on their apexes ————— 15a. *H. muhilensis* subsp. *muhilensis*
- 1b. Outer tepals 10 × 2.5 mm; seed coat cells covered with wrinkled cuticle, pyramidal in outline and short-pointed ————— 15b. *H. muhilensis* subsp. *kansimbensis*

**15a. *Hypoxis muhilensis* subsp. *muhilensis*.**  
Figures. 15D, 17.

Herb to 16 cm high. Outer leaves 2–5 × 0.6–1.0 cm; nerves 11 to 17; inner leaves 9.5–16.0 cm × 3–5 mm; nerves 17 to 19. Scapes 6–9 cm long, hispid apically with tufted trichomes; pedicels hispid, 4–15 mm long. Outer tepals elliptic, 12–13 × ca. 4 mm, densely hispid abaxially; inner tepals narrowly elliptic, ca. 11 × 3.0–3.5 mm, pilose on the lower third of midrib abaxially, 7-nerved; sta-

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Figure 16. *Hypoxis malosana*. —A. Seed. —B. Seed coat sculpture with micropapillae. Both from Lisowski 81121 (POZG).



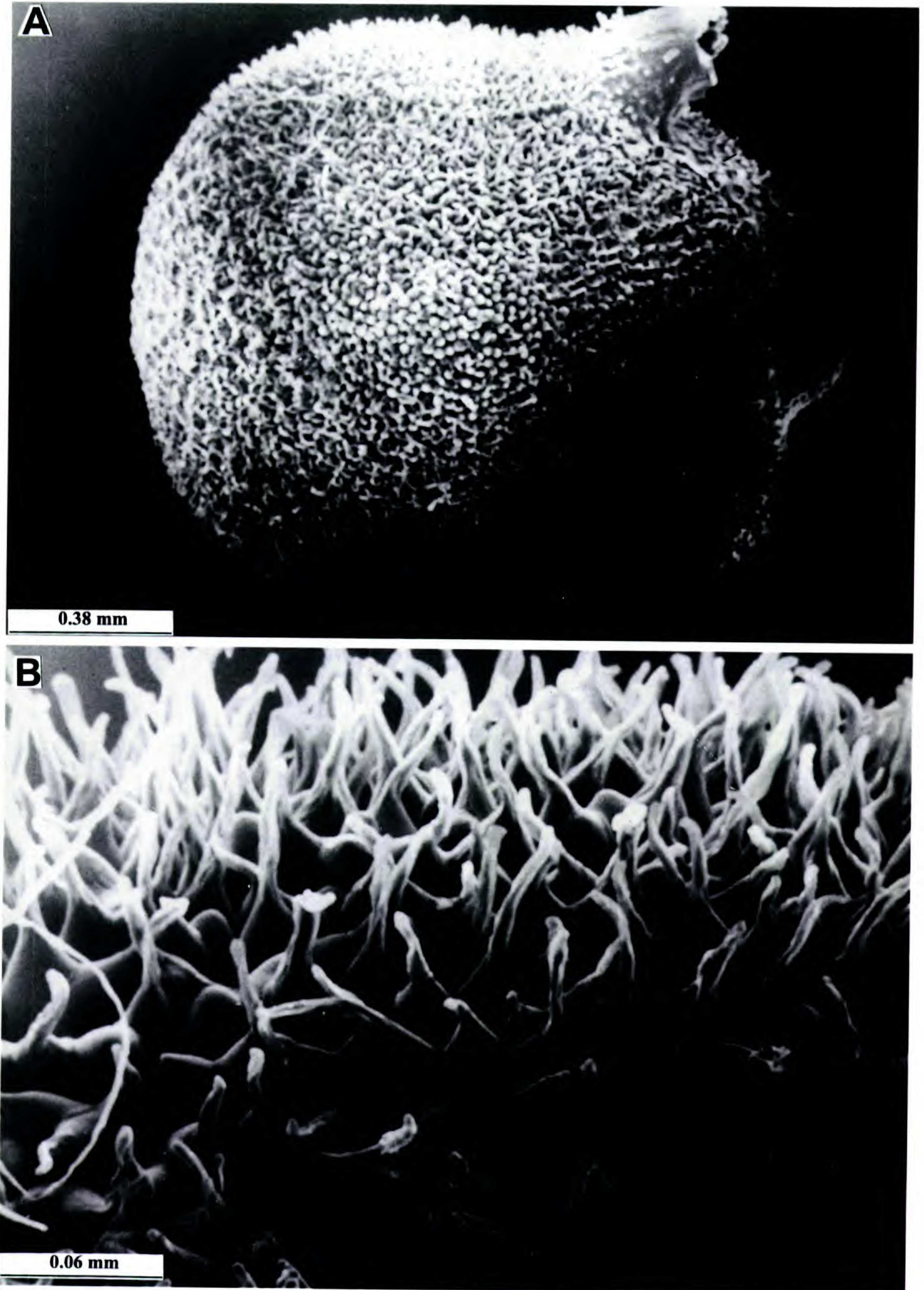


Figure 17. *Hypoxis muhilensis* subsp. *muhilensis*. —A. Seed. —B. Seed coat sculpture. Both from *Lisowski 81134* (POZG).



*mens* equal, ca. 5.5 mm long; *filaments* subulate, 2.5–3.0 mm long; *ovary* 5–7 × 3–4 mm; *style* ca. 0.5 mm long; *stigma* composed of 3 linear lobes, obtuse, 1.5–2.0 mm long. *Capsule* cylindrical, 4–7 × 4–5 mm, hispid; *seeds* ca. 9; seed coat bristly with long filiform pointed projections.

*Additional specimens examined.* CONGO-KINSHASA. **Shaba:** Domaine de Muhila, au-dessus du village Kansimba, *Lisowski* 81134 (POZG).

*Hypoxis muhilensis* subsp. *muhilensis* differs from all other taxa of *Hypoxis* in unique seed testa sculpture (Fig. 17) with the thick cuticle covering the papillae smoothly, but forming elongated appendages at their apices.

**15b. *Hypoxis muhilensis* subsp. *kansimbensis***  
Wiland, *Fragm. Florist. Geobot.* 42: 414. 1997. TYPE: Congo-Kinshasa. Shaba: Domain de Muhila, près de Kansimba, alt. 1400, Nov. 1970, *Lisowski* 81125 (holotype, POZG!). Figure 2C, D.

*Herb* to 35 cm high; *rhizome* not seen. *Outer leaves* 5.5–11.5 × ca. 1.0 cm, ca. 19-nerved; *inner leaves* linear, 22–35 cm × ca. 3 mm wide, ca. 11-nerved. *Scapes* ca. 4, 9–20 cm long, pilose apically with long white tufted trichomes; *pedicels* 4–20 mm long, pilose. *Outer tepals* lanceolate, 10 × 2.5 mm, pilose abaxially, 5-nerved; *inner tepals* ovate, 9 × 3 mm, pilose on lower half of midrib abaxially, 5-nerved; *stamens* unequal; *outer filaments* ca. 3 mm long, *inner* ca. 2 mm long; *ovary* 4 × 2 mm; *style* ca. 2 mm long; *stigma* pyramidal, acute, ca. 1.5 mm long. *Capsule* turbinate, 6–8 × 3–5 mm, pubescent, opening by a transverse slit; *seeds* 10–20, ovoid; seed coat bristly with pointed projections.

Although the seeds, characteristically for the species, are covered with thick cuticle, this is folded differently from the other subspecies. In *H. muhilensis* subsp. *kansimbensis* the cuticle is wrinkled and it projects from the papillae so they look like short pointed pyramids (Fig. 2C, D). The cuticle on the papillae in the other subspecies is smooth and creates elongated projections on their apices (Fig. 17B).

**16. *Hypoxis robusta*** Nel, *Bot. Jahrb. Syst.* 51: 313. 1914. TYPE: Congo-Kinshasa. "Oberer Kongo-Bezirk: Katanga," Oktober 1899, *Verdick* 198 (holotype, BR!). Figures 14C, D, 26.

*Herb* to 80 cm high; *rhizome* subglobose, 3.2–5.2 cm diam. (dried out); tunic black, stiff, 8–12 cm long. *Outer leaves* 3 to 4, sword-like, 5–9 × 3–4 cm, tomentose below, sparsely pubescent above,

hispid on edges and midrib abaxially; trichomes tufted, white; nerves unequal, 27 to 29; *inner leaves* ca. 7, narrow-linear, acute, (12.5–) 54–90 × 1.0 (–1.7) cm; indumentum-like on outer leaves, but sometimes also 2-branched trichomes occur; nerves unequal, 15 to 19. *Scapes* 3 to 6, 10–18 cm × 3 (–4) mm, ciliate in lower half, tomentose in apical half; trichomes tufted, white; *raceme* ca. 10-flowered; flower anthesis acropetal; *bracts* 15 × 2 mm, pubescent on the midrib abaxially; *pedicels* 1–10 mm long, tomentose. *Tepals* 6; *outer tepals* lanceolate or narrowly ovate, (12–) 13–17 × 3–5 (–6) mm, abaxially tomentose, irregularly 7- to 11-nerved; *inner tepals* ovate, acute, (11–) 13–14 (–15) × 4–6 (–8) mm wide, irregularly 7- to 9-nerved, pubescent abaxially along midrib; *stamens* equal, 7–14 mm long; *filaments* subulate, fleshy, 2.5–4.5 mm long; *anthers* oblong, prominently sagittate, slightly emarginate at apex, 5–12 mm long; *ovary* obovoid, 5–7 × 4–5 mm, tomentose; *style* often tapering toward base, (1.5–) 2.5–4.0 mm long; *stigma* 2.5–3.0 mm long, composed of three free lobes. *Capsule* obovoid, 5–6 × 4–5 mm, sparsely pubescent; *seeds* numerous, ovoid or almost globose, ca. 1.5 × 1 mm wide, black and glossy; seed coat colliculate with flat papillae.

*Distribution and ecology.* *Hypoxis robusta* is known only from the Shaba province in Central Africa (Fig. 26). In grassland and wooded grassland, often after burning, on the border of radioactive valley, dembo; sandy soil; alt. ca. 1600 m. Flowering from August to October and in December.

*Additional specimens examined.* CONGO-KINSHASA. **Shaba:** Lukapu, *Verdick* s.n. (BR); Kasompi, *Duvigneaud & Timperman* 2175 (BRLU); Kasompi Ouest, *Duvigneaud & Timperman* 2209 (BRLU); Kasompi Est, *Duvigneaud & Timperman* 2213 (BRLU); sources de la Kamalenge, *Robyns* 3891 (BR); Swambo, *Duvigneaud* s.n. (BRLU); territoire de Jadotville [= Likasi], 10 km W. Mindingi, *Duvigneaud & Timperman* 2551 (BRLU); Kipopo, *Schmitz* 5921 (BR); Plateau de Kundelungu, entre les rivières Petite Lofoi et Kalembe, *Lisowski, Malaisse & Symoens* 12984 (POZG).

The flowers on the type specimen of *H. robusta* are very large, in the upper range of variation in this species. Examination of more specimens revealed that the flowers might be smaller on average. However, lanceolate and acute tepals, large anthers to 14 mm long, and deeply divided stigma are very characteristic of *H. robusta*. Because of a similar geographic distribution and leaves covered with white tufted trichomes, this species is similar to *H. hockii*. The two taxa differ in their ecology, because flowers of *H. hockii* are usually accompanied by inner leaves. Flowers are accompanied by outer



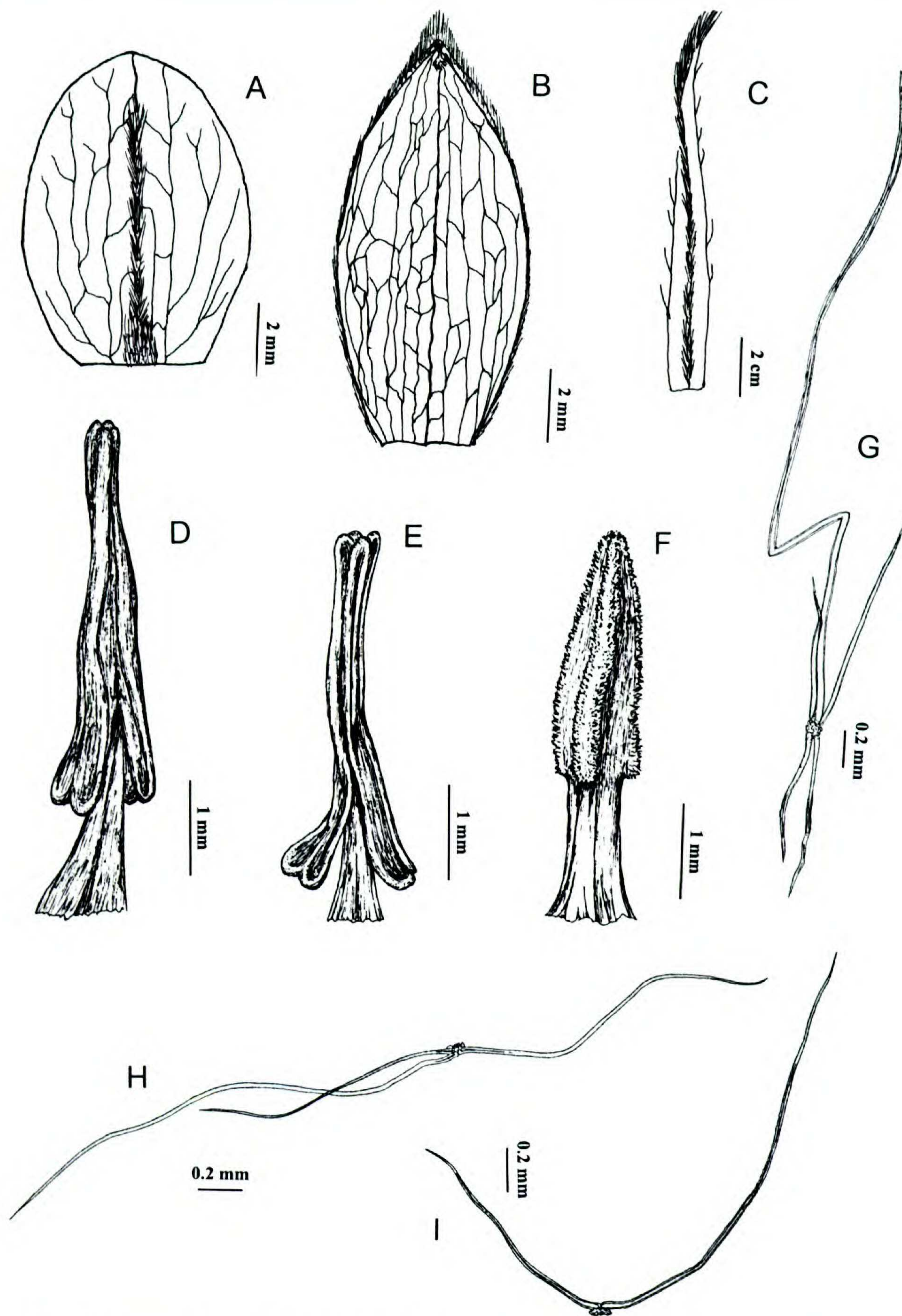


Figure 18. *Hypoxis urceolata*. —A. Dorsal view of inner tepal. —B. Ventral view of outer tepal. —C. Dorsal view of bract. —D. Stamen from the outer whorl (ventral view). —E. Stamen from the inner whorl (ventral view). —F. Pyramidal stigma. —G. Tufted trichome from a scape. H & I. *Hypoxis angustifolia*. Trichomes from scapes. —H. Three-branched trichome. —I. Two-branched trichome. A from *Lejoly 2956* (BRLU); B from *Claessens 1146* (BR); C, D, E, F, G from *Lisowski 48204* (POZG); H from *Lisowski B-7276* (POZG); I from *Lisowski 86119* (POZG).



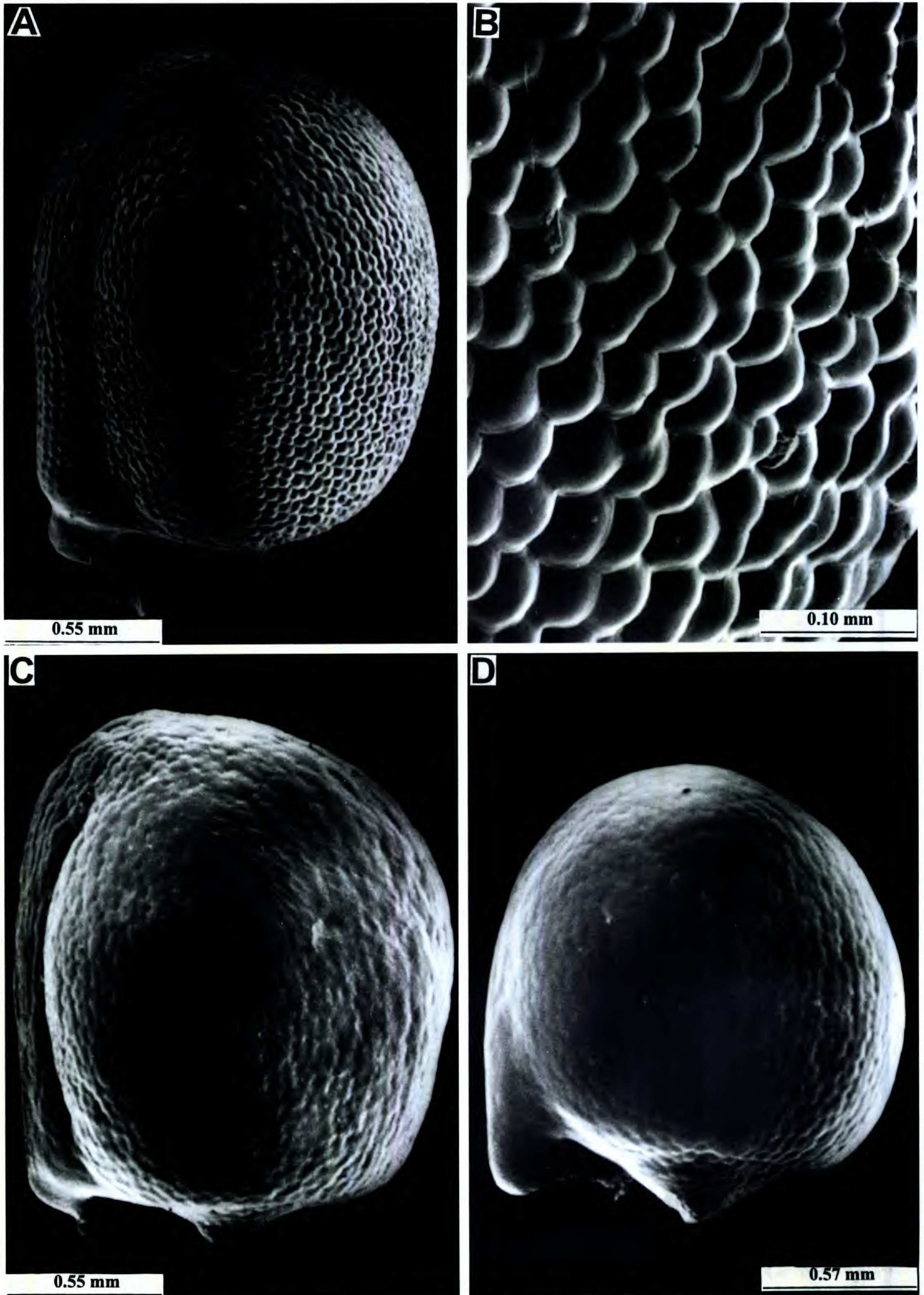


Figure 19. Variability of seeds in *Hypoxis urceolata*. —A, C, D. Seed. —B. Seed coat sculpture. A and B from *Bequaert 4914* (BR); C from *Lebrun 9529* (BR); D from *Lisowski 48204* (POZG).



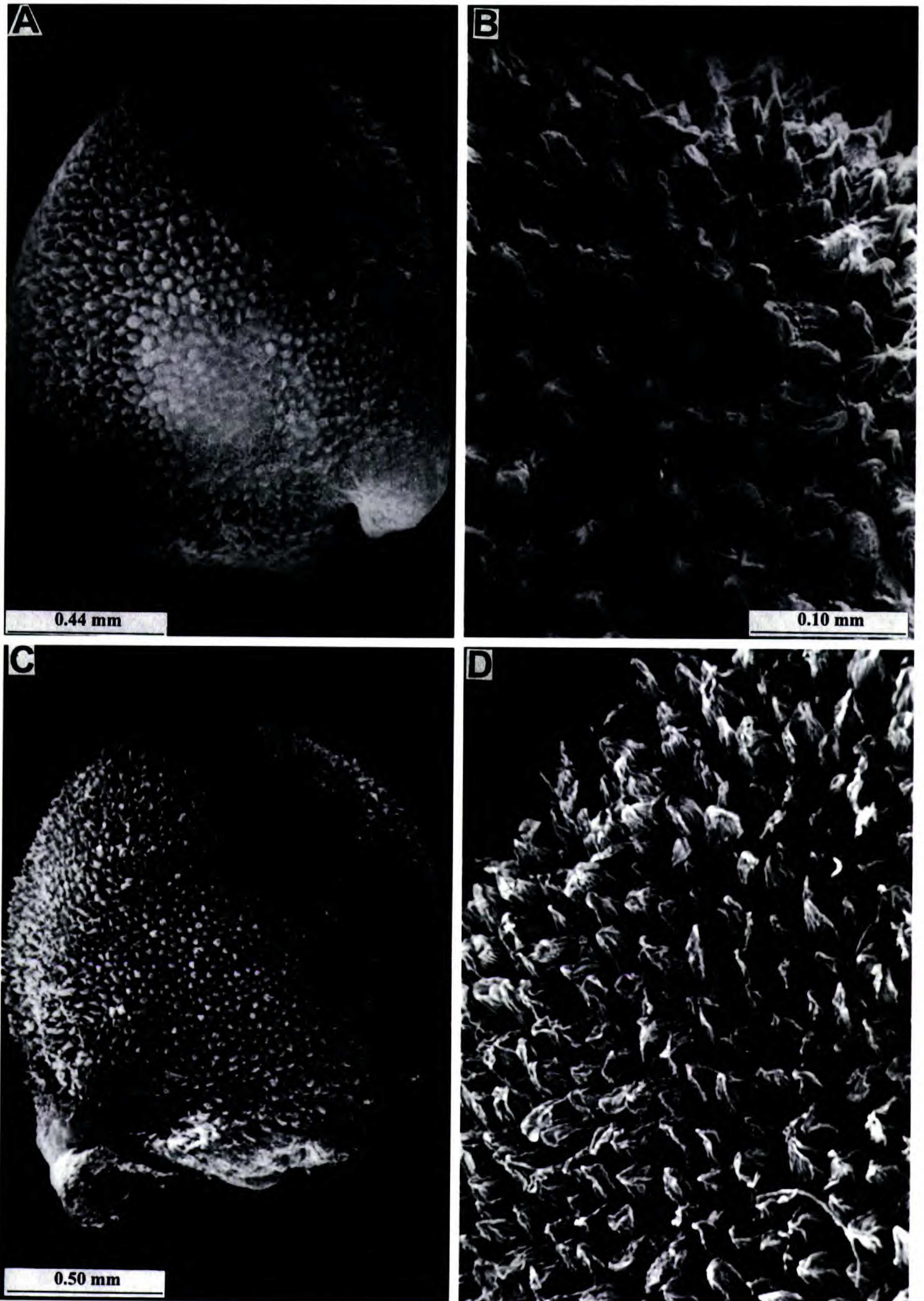


Figure 20. A, B. *Hypoxis symoensiana*. —A. Seed. —B. Seed coat sculpture. C & D. *Hypoxis upembensis*. —C. Seed. —D. Seed coat sculpture. A and B from *Lisowski, Malaisse & Symoens 12058* (POZG); C and D from *de Witte 3698* (BR). Scale for D as in B.



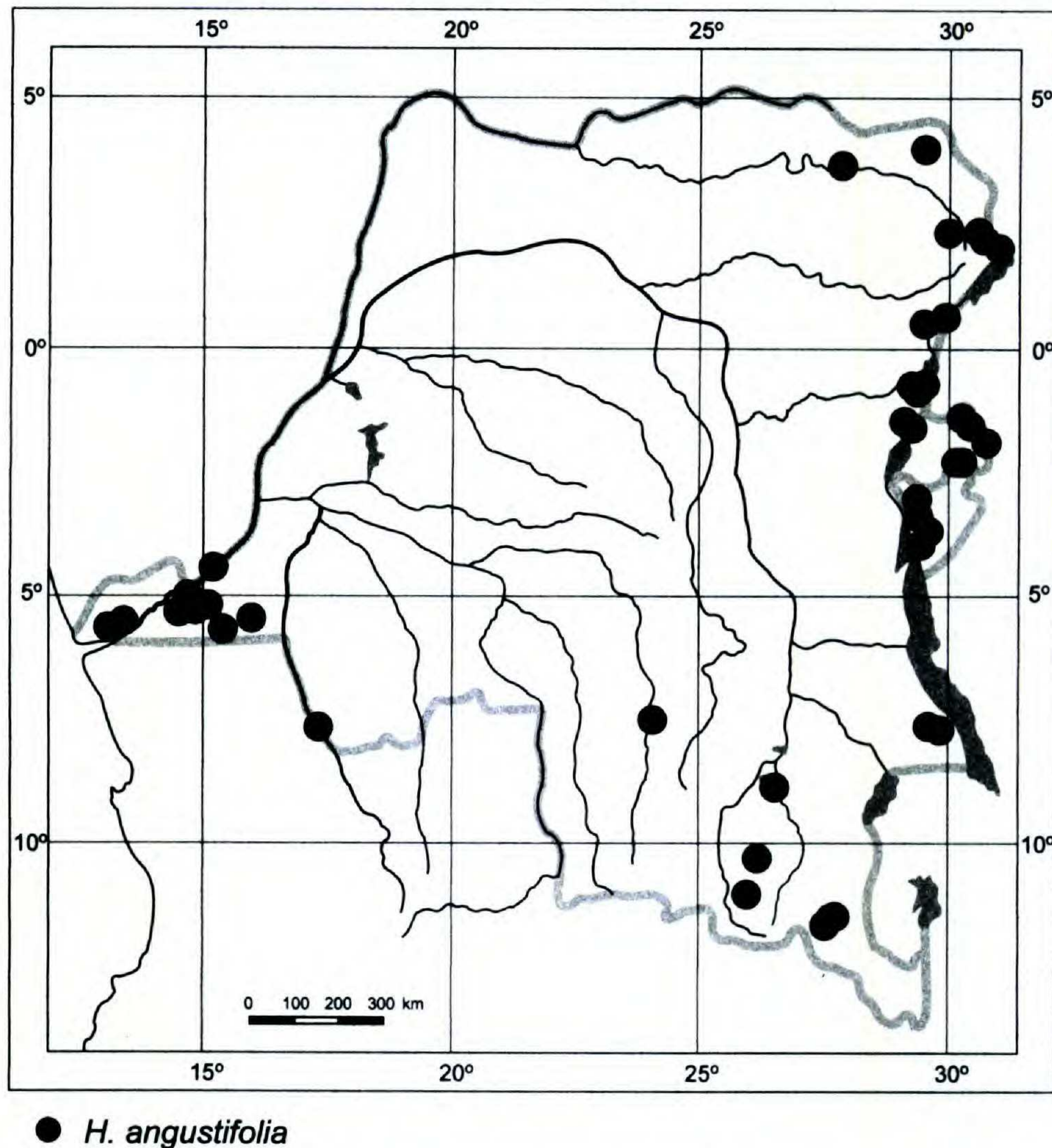


Figure 21. Geographic distribution of *Hypoxis angustifolia* in Central Africa.

leaves only, if any, in *H. robusta*, and its inner leaves do not appear until later. Both species possess black seeds but with different seed coat sculpture (see Figs. 10C–F, 14C, D). The anticlinal cell boundaries in seed coat of *H. robusta* are slightly raised (Fig. 14D), whereas in *H. hockii* var. *colliculata* they are channeled (Fig. 10F). Outer periclinal walls of cells in both taxa are flat (Figs. 10F, 14D), but in the former they are smooth, while in the latter verrucose. Though the anticlinal cell boundaries in two other varieties of *H. hockii* are raised as well, the outer periclinal walls of cells are convex (Fig. 10C, E).

**17. *Hypoxis subspicata*** Pax, Bot. Jahrb. Syst. 15: 143. 1893. TYPES: Angola. “Quangogebiet, 10 ½°s. Br.,” Sep. 1876, *Pogge* 424 (syntype, B!); Malandsche, *Teusch in von Mechow* 249 (syntype, B!). Figure 10A, B.

*Herb* to 34 cm high; *rhizome* cylindrical, ca. 6 cm diam. (dried out); tunic fibrous, stiff, 6–7 cm high. *Outer leaves* ca. 7, linear, acute, 3.0–6.5 × 1.6–2.0 cm, glabrous basally and above, pubescent below with long, tufted trichomes; nerves unequal

ca. 23; *inner leaves* ca. 9, linear-lanceolate, acute, prominently keeled, 20–34 × 0.8–2.0 cm, glabrous above, densely villous below with long white tufted trichomes; nerves of subequal size, closely arranged, ca. 30. *Scapes* 6 or 7, 20–25 cm × ca. 4 mm, narrowly winged and ciliate at base, villous apically with long white tufted trichomes; *cyme* spike-like, 10- to 12-flowered, sometimes branched in apical part and panicle-like; floral anthesis basipetal; the lowermost *bracts* 20–30 × 2–4 mm wide, 5-nerved, pubescent with long trichomes along midrib and on lamina surface in basal and apical parts below, sometimes ciliate; *pedicels* 3–10 mm long, prominently pubescent. *Tepals* 6; *outer tepals* ovate or oblong, 14–15 × ca. 4 mm, densely hispid abaxially, 7- to 9-nerved; *inner tepals* ovate, obtuse, 13–15 × ca. 8 mm, pilose on lower half of midrib abaxially, 7- to 9-nerved; *stamens* equal, ca. 8 mm long; *filaments* subulate, 3.0–3.5 mm long; *anthers* linear, sagittate, fused at apex, 6–7 mm long; *ovary* obconical, ca. 7 × 4 mm, densely pilose; *style* terete, (1.5–) 2–6 mm long; *stigma* composed of 3 linear fused lobes, 2–4 mm long. *Capsule* turbinate, ca. 7 × 5 mm, sparsely white



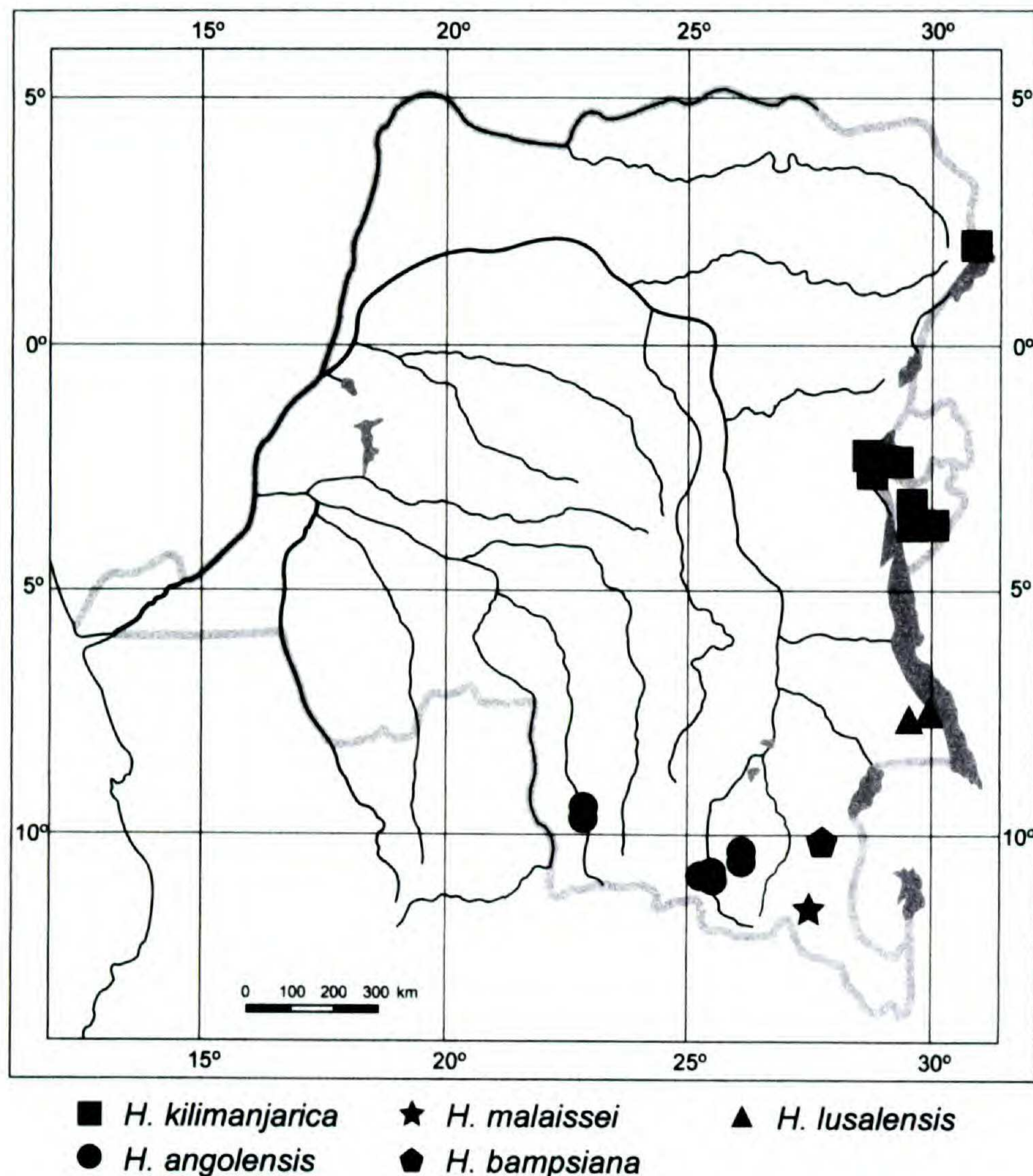


Figure 22. Geographic distribution of *Hypoxis kilimanjarica*, *H. angolensis*, *H. malaisei*, *H. bampsiana*, and *H. lusalensis* in Central Africa.

pubescent; seeds ca. 6, almost globular, ca.  $1.5 \times 1.5$  mm, brown; cuticle thick; seed coat tuberculate, with conical papillae covered closely with wrinkled cuticle.

*Distribution and ecology.* Congo-Kinshasa (Fig. 25), Angola, Zambia. In seasonally dry swamp (dembo); degraded grassland with *Terminalia* and *Diplorhynchus*. Flowering August and November.

*Additional specimens examined.* CONGO-KINSHASA. **Shaba:** Muyeye, Risopoulos 776 (BR); Kapoka, 28 km E de Kasaji, Duvigneaud & Timperman 2528 (BRLU); Dikuluwe, Duvigneaud 4130 (BRLU). ZAMBIA. **Serenje Dist.:** near Serenje, M. Richards 27606 (MO).

The name *H. subspicata* was used for some time in Central Africa as the name for all species with leaves more than 8 mm wide (Geerinck, 1971). Distribution of *H. subspicata* is very similar to distribution of *H. angolensis*, overlapping across range in Angola and Congo-Kinshasa. Both species share leaves with very densely arranged nerves, but leaves of *H. subspicata* are covered on

the entire surface below, whereas leaves of *H. angolensis* are only ciliate on margins and midrib below. These two species have very different inflorescences. *Hypoxis angolensis* possesses racemes with acropetal anthesis, while *H. subspicata* bears cymes with basipetal anthesis. Moreover, seeds of *H. angolensis* are black with thin cuticle, whereas seeds of *H. subspicata* are brown with thicker cuticle. *Hypoxis hockii*, which used to be included in the synonymy of *H. subspicata* (Geerinck, 1971), differs in its acropetal flower anthesis and leaves totally covered with trichomes above and below, and with nerves that are clearly distinct one from another. Moreover, the black seeds of *H. hockii* (Fig. 10) contrast it with *H. subspicata*. Seeds of the latter species are covered with thick wrinkled cuticle (Fig. 10A, B), while seeds of *H. hockii* have thin cuticle (Fig. 10C–F), and in two varieties papillae are of different shape: spiny in *H. hockii* var. *katangensis* (Fig. 10E) and flat in *H. hockii* var. *colliculata* (Fig. 10F).



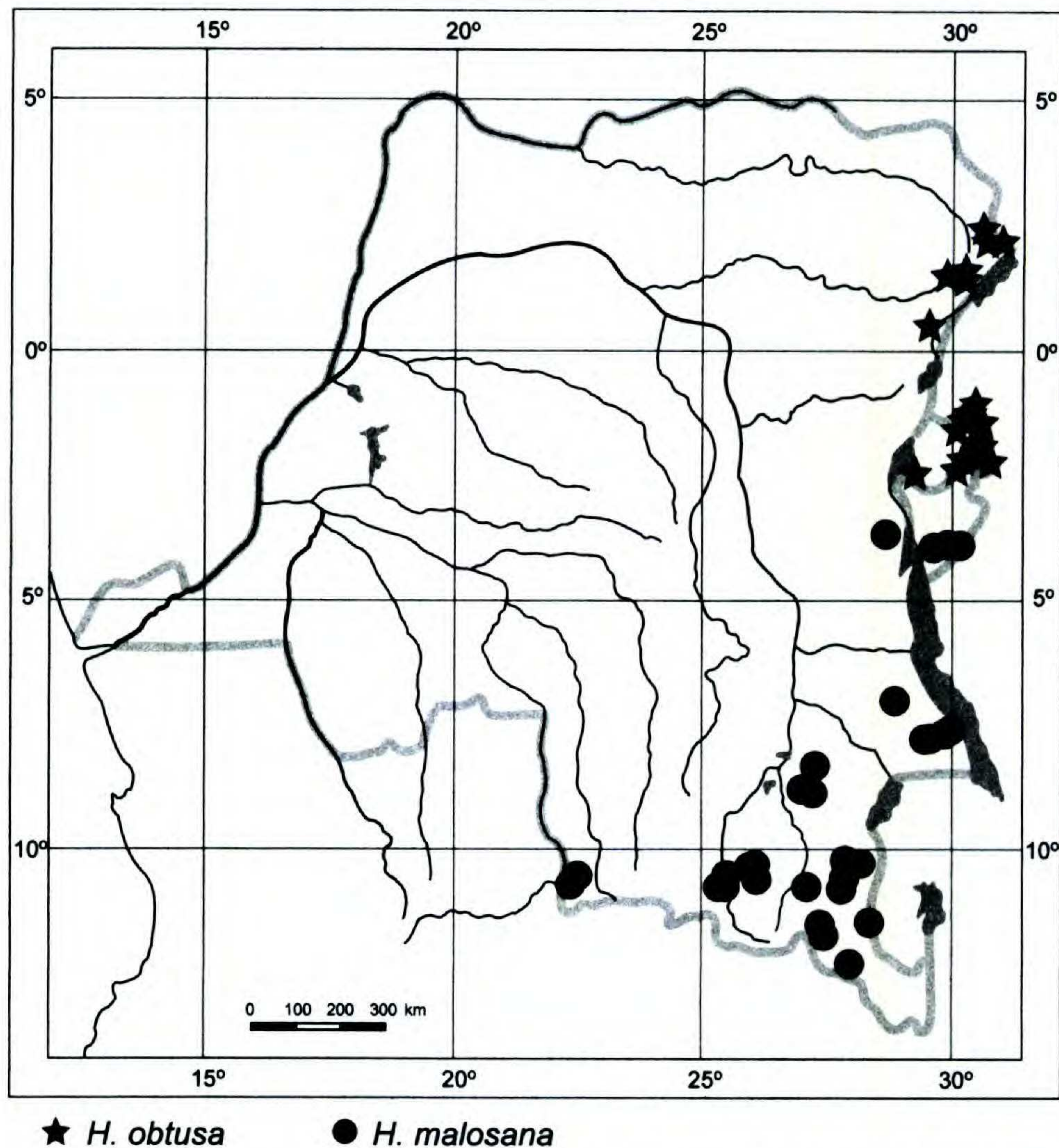


Figure 23. Geographic distribution of *Hypoxis obtusa* and *H. malosana* in Central Africa.

**18. *Hypoxis symoensiana*** Wiland, *Fragm. Florist. Geobot.* 42: 421–422. 1997. TYPE: Congo-Kinshasa. Shaba: “Plateau des Marungu, environ de Kasiki, près de Mare Kasozia,” alt. 2050 m, Nov. 1970, *Lisowski, Symoens & Malaisse 12058* (holotype, POZG!). Figures 20A, B, 6B.

*Herb* to 7.5–10 cm high; *rhizome* ca. 2.5 cm diam. (dried out); *tunic* fibrous, 3.0–5.5 cm high. *Outer leaves* ca. 3, 3.3–5.5 × 0.8–1.2 cm, ovate, ciliate on margins and midrib below; nerves unequal, ca. 21; *inner leaves* narrow-linear, 4.5–10.0 cm × 2–3 mm, long hispid on margins and midrib below; nerves unequal, ca. 9. *Scapes* 4 to 5, 4.5–9.5 cm × ca. 2 mm broad just below inflorescence, narrowly winged and ciliate at base, pubescent; raceme 2- to 4-flowered; *bracts* single, rarely 2, very narrow, 5–10 mm long, pubescent along midrib abaxially; *pedicels* 3–8 mm long, pubescent. *Tepals* 6; *outer tepals* ovate, acute, ca. 7 × 2.5 mm, pubescent abaxially, irregularly 7-nerved; *inner tepals* ovate, obtuse at apex, ca. 7 × 3 mm, pubescent along lower half of midrib adaxially, irregularly 7-nerved; *stamens* equal, ca. 4 mm long; *filaments* ca. 2.5 mm long; *anthers* ca. 3 mm, sagittate, fused at

apex; *ovary* obconical, ca. 3 × 2.5 mm, pubescent; *style* subulate, 1.5 mm long; *stigma* composed of three oblong lobes, emarginate at apex, ca. 1.2 mm long. *Capsule* obovoid, ca. 5 × 4 mm, pubescent, opening apically by a transverse slit; *seeds* numerous, ovoid, ca. 1.8 × 1.2 mm, red-brown; cuticle thick; seed coat bristly with pointed projections.

*Distribution and ecology.* A species known only from three high elevated plateaus in Shaba in Congo-Kinshasa (Fig. 26), where it occurs in grasslands and miombo; alt. 1650–2050 m. Flowering from September to October.

*Additional specimens examined.* CONGO-KINSHASA. **Shaba:** Plateau des Kundelungu, 5 km to the S of W source of the Lutshipuka river, *Malaisse 6042* (POZG); Plateau de la Manika, Kolwezi, *Plancke 167/2613* (BRLU).

Small in size and with hispid indumentum, *Hypoxis symoensiana* is distinguished from other small *Hypoxis* species by its racemose inflorescence (Fig. 6B). It is similar in appearance to *H. canaliculata* (Fig. 6A) because of size and light coloring of indumentum. *Hypoxis symoensiana* differs in its brown seeds covered with thick cuticle as seen in



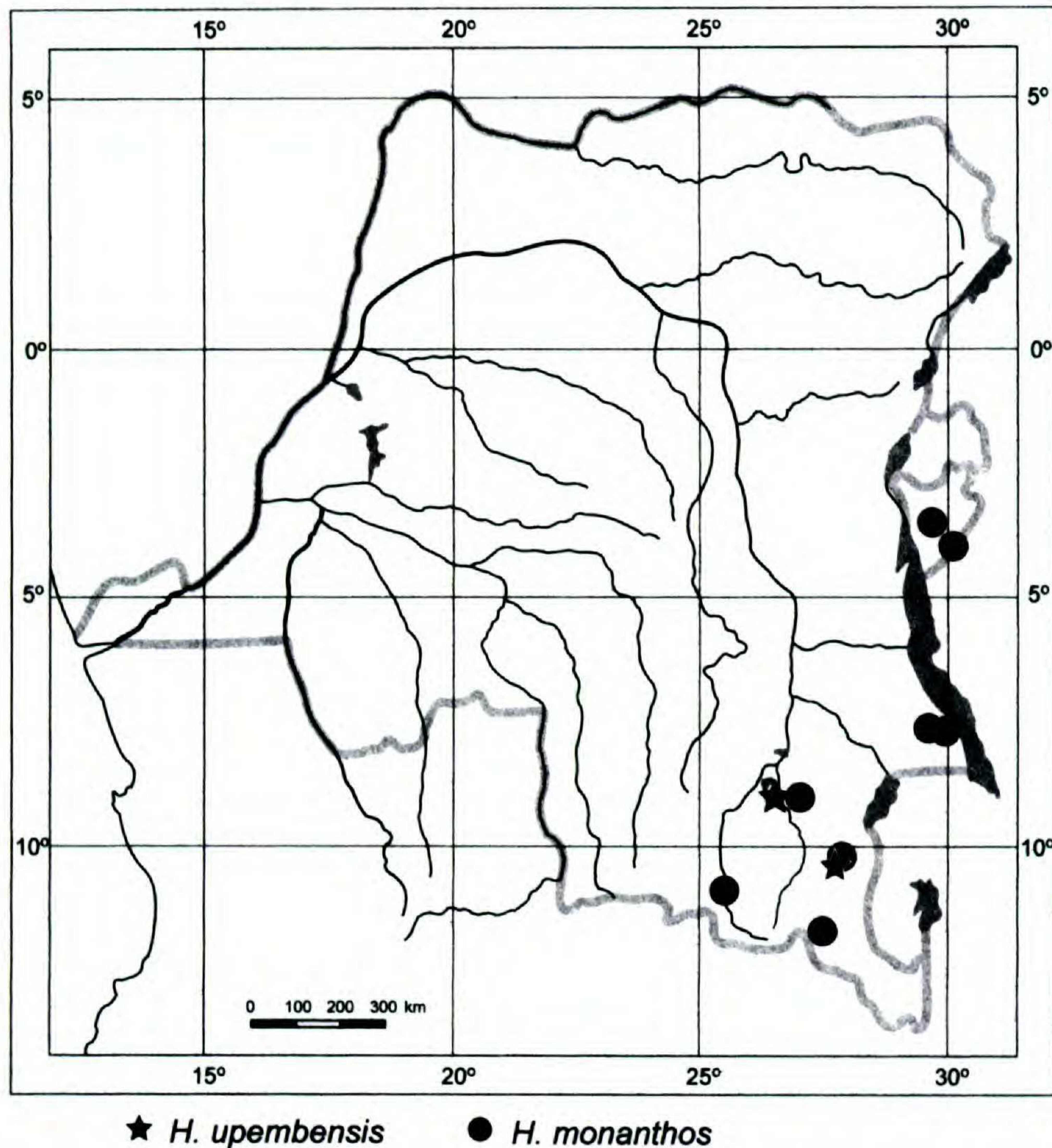


Figure 24. Geographic distribution of *Hypoxis monanthos* and *H. upembensis* in Central Africa.

Figure 20A, B. Seeds are not black with a thinner cuticle, as in the latter species.

**19. *Hypoxis upembensis*** Wiland, *Fragm. Florist. Geobot.* 42: 414. 1997. TYPE: Congo-Kinshasa. Shaba: "Parc National Upemba, riv. Katongo, affluent of Kubale, savane herbeuse, 1750 m," *de Witte 3698* (holotype, BR!). Figures 6E, 20C, D.

*Herb* to 21 cm high; *rhizome* globose, 15 mm diam. (dried out), white inside; tunic membranous and fibrous, to ca. 5 cm. *Leaves* 5 to 10, subulate, linear, 7–21 cm × ca. 2 mm, with membranous margins in the basal part, ca. 9-nerved; young leaves sparsely pilose on margins and midrib below with 2-branched trichomes; old leaves glabrous. *Scapes* 3 to 4, 11.5–21.0 cm × ca. 1 mm, in basal part very narrowly winged and glabrous or with several trichomes, in upper half sparsely pilose with 2-branched trichomes; *inflorescence* 2-flowered; *bracts* distinctly wider in basal part, ca. 11 × 1 mm, 1-nerved, sparsely pilose on the midrib abaxially with simple or 2-branched trichomes; *pedicels* to 6 mm long, pilose with tufted trichomes. *Tepals*

6; *outer tepals* elliptic, ca. 10 × 5 mm, 7-nerved, abaxially pilose; trichomes golden yellow, 2-branched and tufted; *inner tepals* oblong or ovate, acute or obtuse at apex, 9–10 × ca. 4 mm, abaxially pilose at base, 7-nerved; *stamens* equal, ca. 5 mm long; *filaments* ca. 3 mm long; *anthers* linear, ca. 3 mm long, deeply sagittate, fused at apex; *ovary* obconical, 5–7 × ca. 3 mm, pubescent; *style* stout, ca. 2.5 mm long; *stigma* capitate, composed of 3 oblong lobes, ca. 1 mm long. *Capsule* obconical, ca. 6 × 3 mm, pubescent; *seeds* few, irregularly globose, ca. 1.5 × 1.5 mm, brown; cuticle thick; seed coat bristly with pointed projections.

*Distribution and ecology.* Known only from Shaba in Congo-Kinshasa (Fig. 24), where it occurs in grasslands; alt. 1750 m. Flowering in April.

*Additional specimen examined.* CONGO-KINSHASA. Shaba: Kundelungu Plateau, between the source of Lofoi and Katschupa, *Hooper & Townsend 532* (K).

*Vernacular name.* Kadjidji, Kabu (dialect Kiluba).

*Hypoxis upembensis* is a distinctive taxon with its two flowers clustered together and comparatively



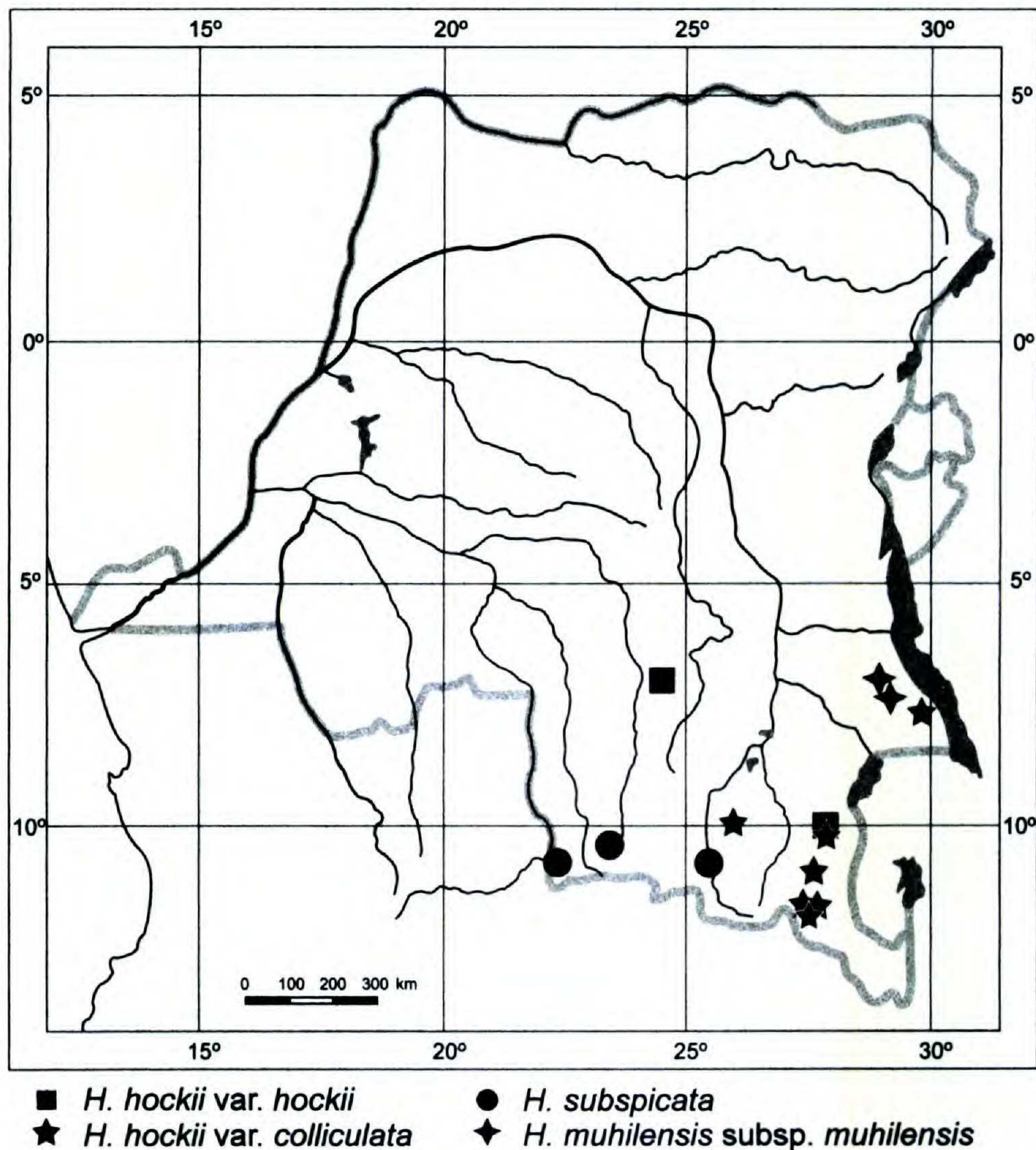


Figure 25. Geographic distribution of *Hypoxis hockii* var. *hockii*, *H. hockii* var. *colliculata*, *H. subspicata*, and *H. muhilensis* subsp. *muhilensis* in Central Africa.

wide tepals (Fig. 6E). Its rhizome is edible (*de Witte* 3698). With *H. angustifolia* this taxon shares similar sparse indumentum composed of 2-branched trichomes and seeds covered with thick cuticle (Figs. 3, 20C, D). The papillae of *H. upembensis* seem to be more elongated than in the former species. *Hypoxis upembensis* is easy to distinguish by its partially fibrous tunic, outer tepals to 5 mm, and shorter pedicels to 6 mm in length. The tunic of *H. angustifolia* is entirely membranous, its tepals are shorter and do not exceed 4 mm in width, but its pedicels are longer, usually to at least 12 mm.

**20. *Hypoxis urceolata*** Nel, Bot. Jahrb. Syst. 51: 336. 1914. TYPE: Tanzania. Sine loc., *Obst s.n.* (syntype, B!). Figures 18A–G, 19.

*Hypoxis crista* Nel, Bot. Jahrb. Syst. 51: 334. 1914. TYPE: Tanzania. "Kilimandscharo, Landschaft des Ngowe (Muengue), auf einem kahlen mit Grass bedeckten Sandhügel, um 1550 m ü. M., Juni 1893," *Volkens* 360 (holotype, B!).

*Hypoxis apiculata* Nel, Bot. Jahrb. Syst. 51: 327. 1914. TYPE: Tanzania. "Kilimandscharo, auf dem Gipfel, N'di (Taita) Berg, February, 1877," *Hildebrandt* 2542 (holotype, B!).

*Hypoxis bequaertii* De Wild., Pl. bequaerti. 1: 49. 1921. TYPE: Congo-Kinshasa. Haut-Zaïre: "entre Irumu et Bogoro, savane herbeuse, fleurs jeunes intérieurement, vertes extérieurement, 7 juillet 1914," *Bequaert* 4919 (syntype, BR!). Kivu: entre Beni et Kasindi, steppe à *Acacia*, fleurs jaunes, 8 août 1914, *Bequaert* 5198 (syntype, BR!).

Herb to 60 cm high; rhizome ovoid, 3.3–6.5 × 2.3–3.0 (4.3) cm (dried out), yellow, orange, or brown inside with yellow sap; tunic fibrous, to 10 cm long. Outer leaves 1 to 5, oblong-ovate, (4.5–) 6–13 × 0.8–2.0 (–2.4) cm, sometimes reflexed, pubescent; trichomes on margins and midrib abaxially tufted, on lamina surface 2-branched; nerves unequal, 17 to 28 (to 33); inner leaves 5 to 15, linear, (11–) 17–60 (–95) × 0.8–2.0 cm, sometimes reflexed; indumentum like above, with trichomes falling off with age; nerves unequal, (12–) 19 to 45. Scapes 4 to 9, 8–45 cm × 2–3 mm, ciliate in lower half, pubescent above; trichomes tufted, ca. 5-branched, golden; raceme 2- to 7-flowered; bracts subulate, keeled, (5–) 9–24 × 1–2 mm, 3-nerved at the lowest flowers, pubescent on midrib abaxially, ciliate on margins; pedicels 0 or 3–35 mm long,



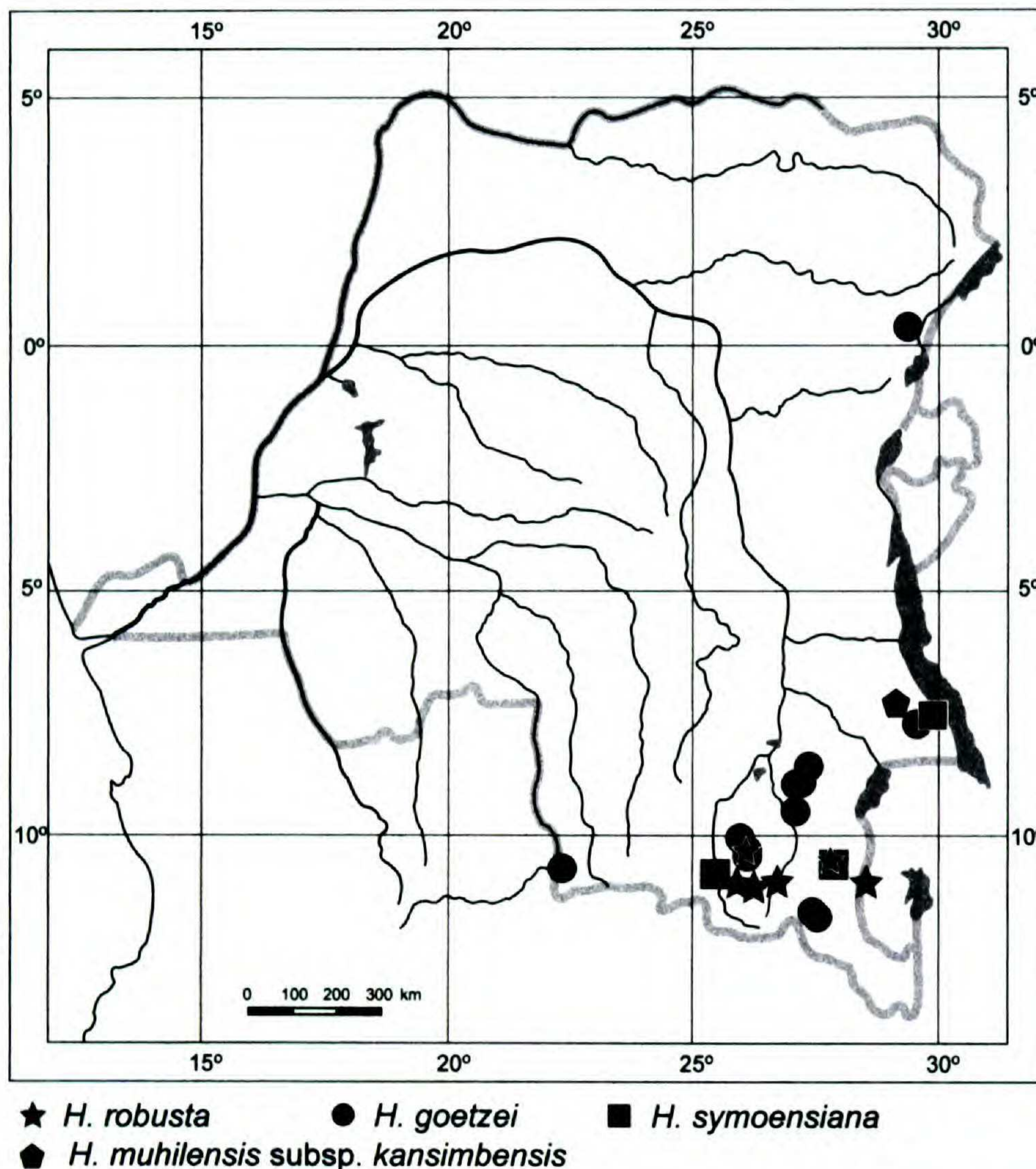


Figure 26. Geographic distribution of *Hypoxis robusta*, *H. goetzei*, *H. symoensiana*, and *H. muhilensis* subsp. *kansimbensis* in Central Africa.

tomentose. *Tepals* 6, all yellow or outer green; *outer tepals* ovate, 8–15 × 4–5 (–6) mm, keeled, pubescent abaxially, irregularly 5- to 7-nerved; *inner tepals* ovate, obtuse, 8–14 × ca. 5 mm, irregularly 5- to 7-nerved, pubescent abaxially along the midrib in lower  $\frac{3}{4}$ ; *stamens* unequal; outer stamens 4–8 mm long; inner stamens 4–7 mm long; *filaments* subulate, 1.5–4.0 mm long; *anthers* oblong, prominently sagittate, fused at apex, 3–6 mm long; *ovary* obconical, 4–10 × 3–4 mm, villous; *style* 3–4 mm long; *stigma* pyramidal, 2–3 mm long, with 3 stripes of papillae. *Capsule* turbinate, 4–10 × 3–5 mm, pubescent; *seeds* numerous, ovoid, ca. 1.5 × 1 mm, black; seed coat colliculate with  $\pm$  flat papillae.

*Distribution and ecology.* Probably all of eastern Africa. In Central Africa in northeastern parts of Congo-Kinshasa and in Rwanda. Occurs in grasslands with xeromorphic shrubs or woodlands; at termite mounds; in herbaceous fallow fields, degraded pasture; in wet areas, water flows, on rocky, kaolin soil; alt. 1200–2000 m. Flowering all months

except June and November. Inflorescences are accompanied by leaves.

*Additional specimens examined.* CONGO-KINSHASA. **Haut-Zaïre:** Mahagi, *Lebrun* 3755 (BR); Nioka, *Germain* 3962 (BR), *Wilboux* 167 (BR), *Menager* 67 (BR); S of Golu, N of Nioka, *Sperry* 353 (BR); Bunia, *Lejoly* 2949 A (BRLU) & 2956 (BRLU, BR), *Claessens* 1146 (BR), *Lisowski* 48204 (POZG); Kilo Moto, *Foscolos* 19 (BR); Bogoro–Geti-Road, *Johnston* 1117 (BR). RWANDA. S. l., *Burgeon* 14 (BR); Mugariro, *Christiaensen* 1553 (BR); Parc National de la Kagera, Kibungu, S de Ndama, *Robyns* 3553 (BR); colline Muhororo, *Troupin* 8864 (BR); plaine d'Uruwita, *Troupin* 5287 (BR); Byumba, colline Rwisirabo, *Troupin* 13969 (BR); colline Kizirakome, *Troupin* 8606 (BR); Gabiro, *Germain* 2854 (BR); environs de Gabiro, *Bouxin & Radoux* 1105 (BR); colline Nyarutovu, *Troupin* 14108 (BR); piste Gabiro–Kakitumba km 18, *Van der Veken* 10754 (BR); Biumba, *Lebrun* 9529 (BR), *Troupin* 2699 (BR); territoire Biumba, Kijojo, *Christiaensen* 800 (BR); Nyakatare route vers Gabiro, *Taton* 957 (BR); Rusumo–Kibungu km 13, *Bamps* 2727 (BR); Rwinkwavu, *Bouxin & Radoux* 1244 (BR); région du Bugesera, colline Biharagu, *Troupin* 9474 (BR); Bulenge, *Van Oosten* 106 (BR), *Liben* 657 (BR); Gashora, *Augier* 2888 (BR); Lac Mohasi, *Becquet* 590 (BR); environs Mimuli, colline Bi-



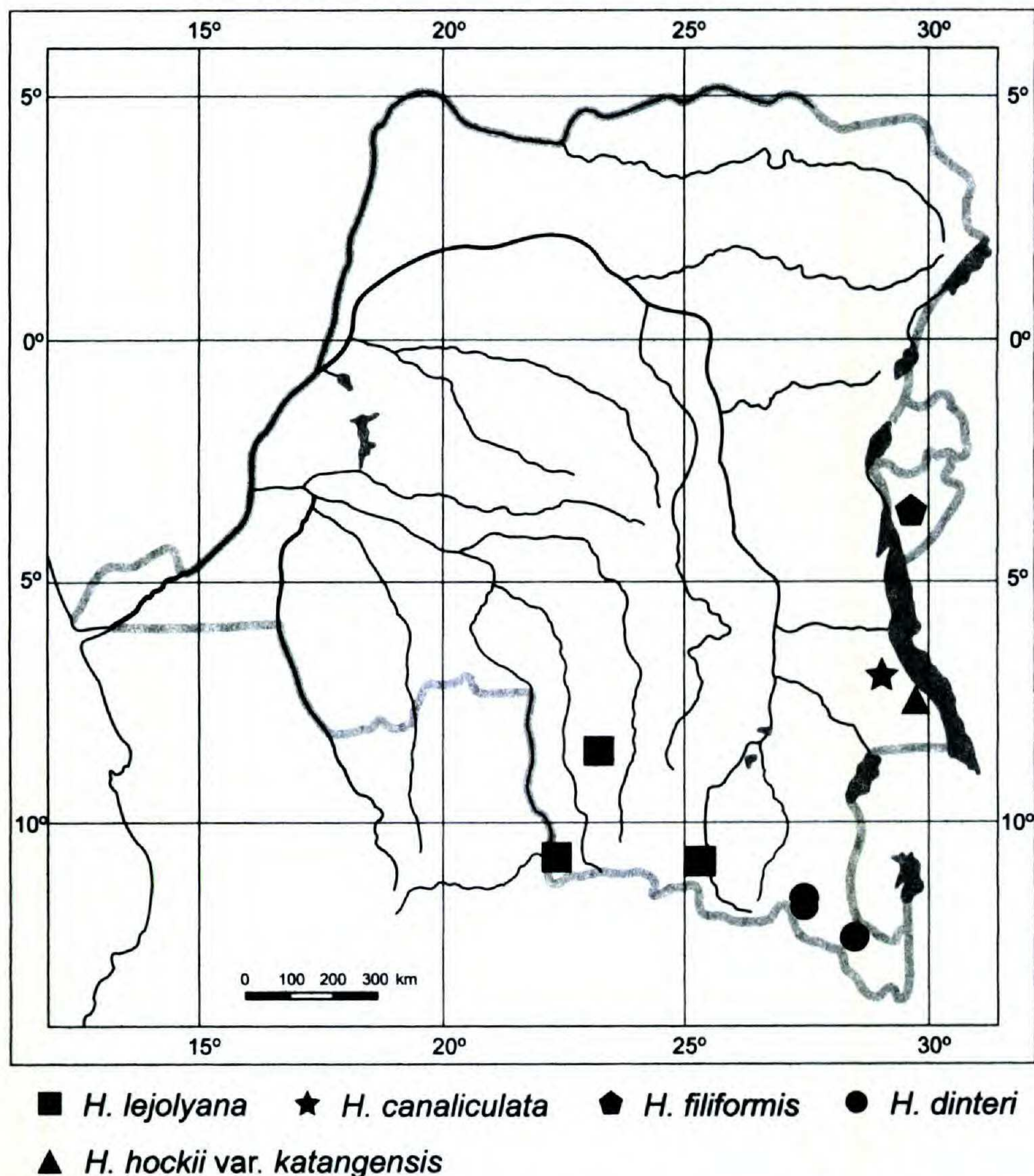


Figure 27. Geographic distribution of *Hypoxis lejolyana*, *H. canaliculata*, *H. filiformis*, *H. dinteri*, and *H. hockii* var. *katangensis* in Central Africa.

bale, *Troupin 4800* (BR); Région du Mutara, route Kigali—Kakitumba vers km 195, *Troupin 8199* (BR).

**Vernacular name.** Moleke (dialect Kilendu); Adingtong, Ucongo (dialect Kilur); Milia-baniki (dialect Babira); Mutjutjuka, Nyaboshya, Nyabohya, Nyabohye, Nyabokyera, Wawazotahili (Kinyarwanda); Isheshe (Rwanda, *Becquet 590*).

The rhizome of *Hypoxis urceolata* is boiled, and the extract is used as a first purgative for new born babies. *Hypoxis urceolata* forms a distinct group in Central Africa because of its distribution in the northern part of the region. This species is, however, very variable in its morphology. Plants differ in leaf width and recurvation. Their indumentum might be of varying density as well. However, stamens are usually fused at the apex (Fig. 18D, E) and the stigma is pyramidal in shape (Fig. 18F). There is no agreement as to what are the proper name and delimitation of this complex taxon in other parts of Africa (see Nordal et al., 1985). Some authors (e.g., Zimudzi, 1996; Nordal, 1997) prefer to use the name *H. villosa* L., which indeed has

priority, but because there is no clear delimitation of the complex, different authors include different entities in its synonymy. I saw only microfiche from LINN with the type of *H. villosa* and South African specimens of this species, but I am convinced that this is not the same species as occurs in Central Africa, because of a different type of inflorescence. *Hypoxis urceolata* possesses a rather dense raceme, while *H. villosa* has a lax corymb. The situation is complicated by proven apomixis in the *H. urceolata* complex, which is also called the *H. obtusa* complex (Nordal et al., 1985; Zimudzi, 1994). *Hypoxis obtusa* is a very distinct South African species with recurved leaves, among Central African species similar in texture to leaves of *H. angolensis*, with approximate nerves and ciliated only on the margins and midrib. Leaves of *H. urceolata* are totally covered with indumentum, and veins are distant one from another. Another name perhaps applicable to the Central African plants is *H. hemerocallidea* Fisch. & Mey. as proposed by Hilliard and Burt (1983) for a group of South African plants



included previously in *H. obtusa* or *H. villosa*. I did not see, however, a type specimen of this species, and because nomenclature applied to this group is one of the most complicated in the whole genus, further studies including materials from South Africa need to be performed to solve this problem. For the purpose of this publication, I therefore decided to use the oldest application of the name for this species in Central Africa, namely *H. urceolata* Nel, which was previously reported from Rwanda (Troupin, 1971; Champluvier, 1987).

*Hypoxis urceolata* is allopatric in Central Africa to all species with leaves of similar size, namely *H. robusta*, *H. subspicata*, *H. angolensis*, and *H. hockii*. A character that usually occurs in the former species, but in none of the others, is a ciliated bract (Fig. 18C). Seeds of *H. urceolata* are always black and glossy and with thin cuticle. The anticlinal cell boundaries are slightly raised (Fig. 19B); outer periclinal walls of cells may be flat (Fig. 19C, D) or concave (Fig. 19A, B), another polymorphic character in this taxon. From *H. subspicata*, the discussed species differs in its seeds (Fig. 19), inner leaves totally covered with indumentum and with distant nerves, and no more than 7 flowers in the racemes. The latter species possesses brown seeds with thick cuticle (Fig. 10A, B), inner leaves glabrous above and with approximate nerves, and 10 to 12 flowers in cymes. The seeds of *H. robusta* are very similar in seed testa sculpture to seeds of *H. urceolata* (Fig. 14C, D). However, the two species differ not only in geographical distribution but also in phenology. *Hypoxis robusta* bears about 10-flowered inflorescences long before leaves, whereas in the latter species they occur simultaneously with leaves producing no more than 7 flowers each. In contrast to *H. urceolata*, *H. angolensis* possesses seeds with the anticlinal cell boundaries slightly channeled (Fig. 2B) and leaves ciliate on midrib and margins below only (Fig. 1A) and with approximate nerves. *Hypoxis hockii* is distinguished by seeds with the raised convex papillae in *H. hockii* subsp. *hockii* (Fig. 10C) and *H. hockii* subsp. *katangensis* (Fig. 10E), as well as flat but micropapillated papillae with channeled anticlinal cell boundaries in *H. hockii* subsp. *colliculata* (Fig. 10F).

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LIST OF SPECIES

1. *Hypoxis angolensis* Baker
2. *Hypoxis angustifolia* Lam.
3. *Hypoxis bampsiana* Wiland
4. *Hypoxis canaliculata* Baker
5. *Hypoxis dinteri* Nel
6. *Hypoxis filiformis* Baker
7. *Hypoxis goetzei* Harms
8. *Hypoxis hockii* De Wild.
- 8a. *Hypoxis hockii* De Wild. var. *hockii*
- 8b. *Hypoxis hockii* var. *colliculata* Wiland
- 8c. *Hypoxis hockii* var. *katangensis* (Nel) Wiland
9. *Hypoxis kilimanjarica* Baker
10. *Hypoxis lejolyana* Wiland
11. *Hypoxis lusalensis* Wiland
12. *Hypoxis malaissei* Wiland
13. *Hypoxis malosana* Baker
14. *Hypoxis monanthos* Baker
- 15a. *Hypoxis muhilensis* Wiland subsp. *muhilensis*
- 15b. *Hypoxis muhilensis* subsp. *kansimbensis*
16. *Hypoxis robusta* Nel
17. *Hypoxis subspicata* Pax
18. *Hypoxis symoensiana* Wiland
19. *Hypoxis upembensis* Wiland
20. *Hypoxis urceolata* Nel

INDEX TO EXSICCATAE

\* indicates type specimens

Augier 2888 (20), 2898 (2).

Bamps 851 (14), 2727 (20), 2878 (9), 3302 (9). Bamps & Malaisse 8052 (2), 8278 (2). Becquet 590 (20), 2153 (13), 2159 (14). Bequaert 3391 (2), 4211 (2), 4919\* (20), 5198\* (20), 5505 (2). Bouxin 429 (9), 984 (9). Bouxin & Radoux 418 (2), 434 (2), 1008 (2), 1105 (20), 1244 (20), 1415 (2). Breyne 2590 (2), 2624 (2), 4711 (2). Bulaimu 58 (5), 715 (7). Burchell *s.n.*\* (20). Burgeon 14 (20), 17 (2), 34 (2). Busse 947\* (7).

Cabu 36 (8b). Christiaensen 736 (2), 800 (20), 1501 (9), 1553 (20), 1620 (9). Claessens 1146 (20). Cooper 462\* (6). Crispiels-Thonon 132 (2).

Dandoy 206 (2), 361 (2). D'Hose 48 (5). Deschamps *s.n.*\* (8). Detilleux 229 (5), 383 (13). de Wilde 273 (2), 467 (2). de Witte 4 (8), 11267 (2), 1130\* (2), 13341 (2), 2714 (7), 2741 (13), 2809 (7), 3698\* (19), 4406 (7), 7181 (13), 7307 (7), 7364 (7), 7451 (7), 7508 (2). Dinter 634\* (5). Doumen 9 (13). Dupuis *s.n.* (2). Duvigneaud 1311 (13), 1319 (13), 1321H (1), 1324 (13), 4129 (13), 4130 (17), 4130 H<sub>1</sub> (13), 4312 (13), 4471(13), 4527 H (1), 4532H (10), 4861 (13), *s.n.* (1), *s.n.* (16). Duvigneaud & Timperman 2175 (16), 2209 (16), 2213 (16), 2264 (1), 2400 (7), 2404 (13), 2406 (13), 2481 (1), 2514 (1), 2519 (10), 2528 (17), 2551 (16), 2626 (13), 2627 (7), 2697 (13), 2700 (7), 2731 (7).

Ecklon 3515\* (6).

Federicq in de Witte 8741 (2). Flamigni 297 (2). Foscolos 19 (20). Fries 1148 (8c), 1275 (4). Froment 681 (9).

Germain 2854 (20), 3962 (20), 6086 (2), 6237 (2), 7191 (2). Gillet *s.n.* (2), *s.n.* (2). Goetze 1416\* (7).

Heine 108 (13), U 111 (13). Hendrickx 4780 (9), 4832



(9). Hens 221 (2). Hildebrandt 2542\* (20). Hock *s.n.\** (7), *s.n.* (7), *s.n.\** (8a), *s.n.* (8a), *s.n.\** (13), *s.n.* (13). Homblé 809 (13), 1091 (2). Hooper & Townsend 532 (19).

Jans 98 (2). Johnston 1117 (20).

Kinet 49 [= Hendrickx 4361] (13). Kisimba, Muzinga, Matamba 136 (13).

Lebrun 3256 (2), 3755 (20), 7557 (2), 7835 (2), 9529 (20). Lejoly 2949A (20), 2956 (20), 3338 (2), 82/1013 (2), 84/719 (9). Lewalle 584 (9), 1102 (9), 3997 (9), 4189 (2), 5029 (2), 5130 (9), 5486 (2). Liben 620 (2), 657 (20), 1231 (2). Liebusch *s.n.\** (9). Liney 212 (5). Lisowski 7274 (13), 7655 (7), 8023 (13), 10710c (14), 48204 (20), 48484 (2), 50994 (7), 56805 (2), 81107 (7), 81109 (13), 81116\* (15a), 81120 (14), 81121 (13), 81122 (13), 81123 (4), 81124 (13), 81125\* (15b), 81134 (15a), 81145 (13), 81146 (13), 82460 (13), 82893 (13), 86119 (2), 92473 (13), B-7173A (14), B-7173B (13), B-7231 (13), B-7270 (7), B-7270A (13), B-7271 (13), B-7272 (13), B-7273 (13), B-7274 (13), B-7276 (2), B-7277 (13), B-7278 (22), B-7279A (13), B-7378 (2). Lisowski, Malaisse & Symoens 178 (10), 184 (14), 737 (3), 810 (13), 1009 (3), 1155 (13), 2652 (14), 5637 (1), 7413 (8), 7470 (13), 7477 (13), 7492 (7), 7565 (8a), 7596 (13), 7615 (3), 7653\* (3), 7654 (8b), 7682\* (8b), 7744 (13), 7822 (13), 8125 (13), 8134A (13), 8268 (14), 8300 (11), 8369 (13), 8453\* (11), 8557 (11), 8574a (8b), 8645 (8), 8665 (7), 8669 (7), 8684 (11), 9557 l (2), 10710A (2), 11797 (8c), 11798 (7), 12058\* (18), 12058A (13), 12573 (14), 12830 (3), 12853 (3), 12859 (3), 12947 (3), 12984 (16), 13279 (1), 13531 (13), B-7279 (3). Louis 4587 (2). Lukuesa 116 (1).

Malaisse 6042 (18), 6100 (13), 7403\* (12), 8988 (2),

13562 (13), 13695 (8b), 13696 (7). Menager 67 (20). Michel 2534 (14), 5007 (9). Mortelmans 89 (7). Mullenders 2346 (2).

Nicolas 502 (1). Niyongere 95 (6). Noirfalise 826 (2).

Obst *s.n.\** (20). Odon in Gillet *s.n.* (2). Overlaet 712 (10).

Pauwels 6009 (2), 6922 (8b). Plancke 63/911 (7), 127-1741 (7), 158/2184\* (10), 159/2206 (13), 159/2214 (13), 167/2550 (1), 167/2613 (18). Pogge 424 (17).

Quarré 704 (7), 719 (13), 765 (8b), 921 (7), 2673 (8a), 3416 (7), 3527 (13), 3717 (13), 4314 (13), 5056 (2), 6035 (7), 7252 (7), 7252 (11), 7256 (13).

Rameloo 4775 (13). Reekmans 23 (9), 756 (9), 1335 (9), 2065 (9), 2906 (2), 5719 (14). Richards 27606 (17). Risopoulos 776 (17). Robyns 3553 (20), 3587 (7), 3604 (13), 3891 (16).

Schajes 2398 (13), 2985 (1), 3032 (13). Schmitz 2109 (13), 2977 (1), 4198 (13), 4199 (8b), 4803 (7), 5855 (13), 5921 (16), 7499 (7), 7675 (13). Scops 168 (2). Smets 13 (9). Sperry 353 (20). Spyut & Muchali 3462 (1). Staner 2077 (13). Stauffer 500 (2). Streel 331(13). Symoens 779 (13), 5886 (1), 13672 (13).

Taton 437 (2), 957 (20). Teuscz in von Mechow 249\* (17), Troupin 1243 (2), 1308 (2), 2699 (20), 4230 (2), 4800 (20), 5287 (20), 6776 (2), 8199 (20), 8606 (20), 8864 (20), 9474 (20), 13969 (20), 14108 (20), 14109 (2).

Van der Veken 10754 (20). Van Oosten 106 (20), 120 (2). Vanderyst 37242 (2), *s.n.* (2), *s.n.* (2). Verdick 198 (16), *s.n.* (16), *s.n.\** (8c). Volkens 360\* (20), 781\* (9).

Wagemans 285 (2). Welwitsch 4057\* (14), 4058\* (4), 4059\* (1). Whyte *s.n.\** (13). Wilbaux 167 (20). Williams 18 (2).